SCIENCE

Friday, November 26, 1909

CONTENTS

PRELIMINARY PROGRAM OF THE BOSTON MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The sixty-first meeting of the American Association for the Advancement of Science, and the eighth of the Convocation Week meetings, will be held in Boston, December 27, 1909, to January 1, 1910, at the invitation of Harvard University and the Massachusetts Institute of Technology.

The opening session of the association will be held at 10 o'clock A.M., on Monday, December 27, in Huntington Hall, Rogers Building, Massachusetts Institute of Technology. The meeting will be called to order by the retiring president, Professor T. C. Chamberlin, who will introduce the president of the meeting, Dr. David Starr Jordan. Addresses of welcome will be delivered by Dean W. C. Sabine, for Harvard University, and by President R. A. Maclaurin, of the Massachusetts Institute of Technology, and President Jordan will reply.

The addresses by retiring vice-presidents will be given as follows:

December 27, at 2:30 P.M.

Vice-president Keyser, before the Section of Mathematics and Astronomy. Title: "The Thesis of Modern Logistic."

Vice-president Sumner, before the Section of Social and Economic Science.

Vice-president Willis, before the Section of Geology and Geography.

Vice-president Herrick, before the Section of Zoology. Title: "The Evolution of Intelligence and its Organs."

December 28, at 2:30 P.M.

Vice-president Guthe, before the Section of

Physics. Title: "Some Reforms needed in the Teaching of Physics."

Vice-president Richards, before the Section of Botany. Title: "The Nature of Response to Chemical Stimulation."

Vice-president Kahlenberg, before the Section of Chemistry. Title: "The Past and Future of the Study of Solutions."

Vice-president Howell, before the Section of Physiology and Experimental Medicine.

DECEMBER 29, AT 2:30 P.M.

Vice-president Swain, before the Section of Mechanical Science and Engineering. Title: "The Profession of Engineering and its Relation to the American Association for the Advancement of Science."

Vice-president Dewey, before the Section of Education. Title: "Science as a Method of Thinking and Science as Information in Education."

Vice-president Woodworth, before the Section of Anthropology and Psychology. Title: "Racial Differences in Mental Traits."

In accordance with the resolutions of the council, there will be a day or session devoted by each section to a program of general interest which will include the vice-presidential address, but there will be no programs of special papers at the Boston meeting, provided that the corresponding national society meets at the same time and place.

At 8:30 o'clock on Monday evening the retiring president will give his address followed by a reception tendered by the local committee.

On the following days the sections and societies will hold their regular sessions. On Tuesday evening a popular lecture complimentary to the citizens of Boston will be given by Dr. C. W. Stiles, of the Public Health and Marine Hospital Service, on "The Hookworm Disease in the South." On Wednesday evening will be the annual dinner of the American Society of Naturalists. The dinners and smokers of other societies will be announced on their programs.

The Brunswick will be the hotel headquarters of the association. Other hotels near Copley Square are: Hotel Westminster, Copley Square Hotel, Hotel Lenox, Hotel Victoria, Hotel Vendome, Hotel Oxford, Hotel Nottingham and the Touraine.

A railroad rate of one fare and three fifths for the round trip, on the certificate plan, has been granted by the Eastern Canadian, the Central and the New England Passenger Associations (not including the Eastern and the Metropolitan Steamship Companies), and by the Trunk Line Association. From the states of California, Nevada, Oregon, Washington and west of, and including, Mission Junction, B. C.; the Transcontinental Passenger Association has on sale daily Nine Months Tourists fares, approximating two cents per mile in each direction, or about one fare and one third for the round trip. The nine months fares apply to the eastern gateways of the transcontinental territory, and station agents will advise delegates as to the eastern points to which it will be most advantageous for them to purchase nine months tickets in rebuying through to Boston. The Western Association has on sale revised one-way fares in effect to Chicago, Peoria and St. Louis. The fares to Chicago, Peoria and St. Louis from a large part of the Western Passenger Association territory are now on the basis of two cents per mile; hence, with the reduced fares from the three cities named, the net rate amounts practically to a rate of fare and three fifths for the round trip.

The provisional plan of meeting places is as follows:

At the Institute of Technology.—Rogers Building: General session and president's address, Huntington Hall. Meetings of Council, Room 16. Section A, American Mathematical Society, Huntington Hall. *Walker Building:* Section B, American Physical Society, Eastern Association of Physics Teachers and Physics Teachers Associa-

tion of Washington, Room 22. Section L, The American Federation of Teachers, Association of Mathematical Teachers of New England, Room 23. *Lowell Building:* Section C, American Chemical Society, Room 6, etc. *Engineering Building A:* Section D, Room 31. *Engineering Building B:* Section H, American Anthropological Association, Room 11. American Folk-Lore Society, Room 11. Section I, Room 20.

At the Harvard Medical School.—Section F, The American Society of Zoologists. Section G, The Botanical Society of America. Section K, American Physiological Society, Association of American Anatomists, Society of American Bacteriologists, American Society of Naturalists, Entomological Society of America, Association of Economic Entomologists, American Society of Biological Chemists.

At the Boston Society of Natural History.—The Sullivant Moss Society, American Nature-Study Society.

At Cambridge.—The American Psychological Association, Emerson Hall, Harvard University. The Geological Society of America, Geological Room, Agassiz Museum, Harvard University. Section E, Geological Room, Agassiz Museum, Harvard University. Association of American Geographers, Geological Room, Agassiz Museum, Harvard University.

The officers of the association for the Boston meeting are:

President—David Starr Jordan, Leland Stanford Junior University, Stanford University, Cal.

Vice-presidents—Section A—Mathematics and Astronomy—Ernest W. Brown, Yale University, New Haven, Conn. Section B—Physics—Louis A. Bauer, Carnegie Institution, Washington, D. C. Section C—Chemistry—William McPherson, Ohio State University, Columbus, Ohio. Section D—Mechanical Science and Engineering—John F. Hayford, U. S. Coast and Geodetic Survey, Washington, D. C. Section E—Geology and Geography—Reginald W. Brock, Canadian Geological Survey, Kingston, Ontario, Canada. Section F—Zoology—William E. Ritter, University of California, Berkeley, Cal. Section G—Botany—David P. Penhallow, McGill University, Montreal, Canada. Section H—Anthropology and Psychology—Wm. H. Holmes, Bureau of American Ethnology, Washington, D. C. Section I—Social and Economic Science—Byron W. Holt, 54 Broad St., New York, N. Y. Section K—Physiology and Experimental Medicine—Charles Sedgwick Minot, Harvard Medical School, Boston, Mass. Section L—Education—James E. Russell, Columbia University, New York, N. Y.

Permanent Secretary—L. O. Howard, Smithsonian Institution, Washington, D. C.

General Secretary—Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

Secretary of the Council—Francis G. Benedict, Nutrition Laboratory, Carnegie Institution, Boston, Mass.

Secretaries of the Sections—A—Mathematics and Astronomy—George A. Miller, University of Illinois, Urbana, Ill. B—Physics—A. D. Cole, Ohio State University, Columbus, Ohio. C—Chemistry—C. H. Herty, University of North Carolina, Chapel Hill, N. C. D—Mechanical Science and Engineering—G. W. Bissell, Michigan Agricultural College, East Lansing, Mich. E—Geology and Geography—F. P. Gulliver, Norwich, Conn. F—Zoology—Maurice A. Bigelow, Columbia University, New York, N. Y. G—Botany—H. C. Cowles, University of Chicago, Chicago, Ill. H—Anthropology and Psychology—George Grant MacCurdy, Yale University, New Haven, Conn. I—Social and Economic Science—John Franklin Crowell, 44 Broad St., New York, N. Y. (In absence of J. Pease Norton, Yale University, New Haven, Conn.) K—Physiology and Experimental Medicine—George T. Kemp, Hotel Beardsley, Champaign, Ill. L—Education—C. R. Mann, University of Chicago, Chicago, Ill.

Treasurer—R. S. Woodward, Carnegie Institution, Washington, D. C.

Local Executive Committee—Harry W. Tyler, chairman, Thomas Barbour, J. S. Kingsley, Edward R. Warren, John Warren, George W. Swett, secretary.

The following societies have indicated their intention to meet in Boston during Convocation Week:

The American Society of Naturalists.—December 29. *Eastern Branch*—Secretary, Dr. H. McE. Knower, University of Toronto, Toronto, Canada. *Central Branch*—Secretary, Dr. Thomas G. Lee, University of Minnesota, Minneapolis, Minn.

American Mathematical Society.—December 28–30. Secretary, Dr. F. N. Cole, 501 West 116th St., New York City.

Association of American Geographers.—December 30 to January 1. Secretary, Professor Albert Perry Brigham, Colgate University, Hamilton, N. Y.

The Geological Society of America.—December

28–30. Secretary, Dr. Edmund Otis Hovey, American Museum of Natural History, New York City.

Association of Economic Entomologists.—December 28 and 29. Secretary, A. F. Burgess, U. S. Department of Agriculture, Washington, D. C.

American Nature-Study Society.—January 1. Secretary, Dr. M. A. Bigelow, Columbia University, New York City.

Association of American Anatomists.—December 28–30. Secretary, Dr. G. Carl Huber, Ann Arbor, Mich.

The American Chemical Society.—During the entire week. Secretary, Professor Charles L. Parsons, New Hampshire College, Durham, N. H.

American Society of Vertebrate Paleontologists.—December 28–30, with the Geological Society of America. Secretary, Mr. E. S. Riggs, Field Museum of Natural History, Chicago, Ill.

American Society of Zoologists (Central Branch in joint meeting with, and under the auspices of, the Eastern Branch).—December 28–30. *Eastern Branch*—Secretary, Professor Lorande Loss Woodruff, Yale University, New Haven, Conn. *Central Branch*—Secretary, Professor Charles Zeleny, University of Illinois, Urbana, Ill.

The American Physical Society.—Secretary, Professor Ernest Merritt, Ithaca, N. Y.

The American Psychological Association.—December 29–31. Secretary, Professor A. H. Pierce, Smith College, Northampton, Mass.

The American Physiological Society.—December 28–30. Secretary, Dr. Reid Hunt, U. S. Public Health and Marine Hospital Service, Washington, D. C.

American Anthropological Association.—December 27–31. Secretary, Dr. George Grant MacCurdy, New Haven, Conn.

The Entomological Society of America.—December 30 and 31. Secretary, J. Chester Bradley, Ithaca, N. Y.

The American Folk-Lore Society.—Professor R. B. Dixon, Peabody Museum, Cambridge, Mass.

American Federation of Teachers of the Mathematical and the Natural Sciences.—December 27 and 28. Secretary, Dr. C. R. Mann, University of Chicago, Chicago, Ill.

American Society of Biological Chemists.—Secretary, Dr. William J. Gies, 437 West 59th St., New York City.

Sullivant Moss Society.—December 30. Secretary, Mrs. Annie Morrill Smith, 78 Orange St., Brooklyn, N. Y.

Botanical Society of America.—December 28–31. Secretary, Dr. Duncan Starr Johnson, Johns Hopkins University, Baltimore, Md.

Society of American Bacteriologists.—December 28–30. Secretary, Dr. Norman McL. Harris, University of Chicago, Chicago, Ill.

Association of Mathematical Teachers in New England.—December 28. Secretary, George W. Evans, Charlestown High School, Charlestown, Mass.

Eastern Association of Physics Teachers.—Meets in conjunction with American Federation of Teachers of the Mathematical and Natural Sciences.

Physics Teachers of Washington, D. C.—Meets in conjunction with American Federation of Teachers. Secretary, Dr. Howard L. Hodgkins, George Washington University, Washington, D. C.

American Phytopathological Society.—Secretary, C. L. Shear, U. S. Department of Agriculture, Washington, D. C.

American Alpine Club.—December 30. Secretary, Dr. Henry G. Bryant, Room 806 Land Title Building, Philadelphia, Pa.

American Breeders' Association.—Meeting of Eugenics Committee. Secretary, Dr. Chas. B. Davenport, Cold Spring Harbor, N. Y.

OUR FOOD FROM THE WATERS[1]

At the last meeting of the British Association in Canada (Toronto, 1897) I was able to lay before Section D a preliminary account of the results of running sea-water through four silk tow-nets of different degrees of fineness continuously day and night during the voyage from Liverpool to Quebec. During the eight days' traverse of the North Atlantic, the nets were emptied and the contents examined morning and evening, so that each such gathering was approximately a twelve hours' catch, and each day and each night of the voyage was represented by four gatherings. This method of collecting samples of the surface fauna of the sea in any required quantity per day or hour from an ocean liner going at full speed was suggested to me by Sir John Murray of the *Challenger* expedition, and was first practised, I believe, by Murray himself in crossing the Atlantic. I

[1] Abstract of evening discourse, delivered before the British Association at Winnipeg on August 31, 1909.

have since been able to make similar traverses of several of the great oceans, in addition to the North Atlantic, namely, twice across the equator and through the South Atlantic, between England and South Africa, and four times through the Mediterranean, the Red Sea and the Indian Ocean to Ceylon; and no doubt other naturalists have done much the same. The method is simple, effective and inexpensive; and the gatherings, if taken continuously, give a series of samples amounting to a section through the surface layer of the sea, a certain volume of water being pumped in continuously through the bottom of the ship, and strained through the fine silk nets, the mesh of which may be the two-hundredth of an inch across, before passing out into the sea again. In examining with a microscope such a series of gatherings across an ocean, two facts are brought prominently before the mind: (1) the constant presence of a certain amount of minute living things; (2) the very great variation in the quantity and in the nature of these organisms.

[Illustrations showing this were given.]

Such gatherings taken continuously from an ocean liner give, however, information only in regard to the surface fauna and flora of the sea, including many organisms of fundamental importance to man as the immediate or the ultimate food of fishes and whales and other useful animals.

[Examples were shown.]

It was therefore a great advance in planktology when Professor Victor Hensen (1887) introduced his vertical, quantitative nets which could be lowered down and drawn up through any required zones of the water. The highly original ideas and the ingenious methods of Hensen and his colleagues of the Kiel School of Planktology—whether all the conclusions which have been drawn from their results be accepted or not—have at the least inaugurated a new epoch in such oceanographic work; and have inspired a large number of disciples, critics and workers in most civilized countries, with the result that the distribution of minute organisms in the oceans and the fresh waters of the globe are now much more fully known than was the case twenty, or even ten, years ago. But perhaps the dominant feeling on the part of those engaged in this work is that, notwithstanding all this activity in research and the mass of published literature which it has given rise to, much still remains to be done, and that the planktologist is still face to face with some of the most important unsolved problems of biology.

It is only possible in an address such as this to select a few points for demonstration and for criticism—the latter not with any intention of disparaging the stimulating work that has been done, but rather with the view of emphasizing the difficulties, of deprecating premature conclusions and of advocating more minute and more constant observations.

The fundamental ideas of Hensen were that the plankton, or assemblage of more or less minute drifting organisms (both animals and plants) in the sea, is uniformly distributed over an area where the physical conditions are approximately the same, and that by taking a comparatively small number of samples it would be possible to calculate the quantity of plankton contained at the time of observation in a given sea area, and to trace the changes of this plankton both in space and in time. This was a sufficiently grand conception, and it has been of great service to science by stimulating many workers to further research. In order to obtain answers to the problems before him, Hensen devised nets of the finest silk of about 6,000 meshes in the square centimeter, to be hauled up from

the bottom to the surface, and having their constants determined so that it is known what volume of water passes through the net under certain conditions, and yields a certain quantity of plankton.

[Examples of the nets and the methods of working shown.]

Now if this constancy of distribution postulated by Hensen could be relied upon over considerable areas of the sea, far-reaching conclusions, having important bearings upon fisheries questions, might be arrived at; and such have, in fact, been put forward by the Kiel planktologists and their followers—such as the calculation by Hensen and Apstein that the North Sea in the spring of 1895 contained at least 157 billions of the eggs and larvæ of certain edible fish; and from this figure and the average numbers of eggs produced by the fish, their further computation of the total number of the mature fish population which produced the eggs—a grand conclusion, but one based upon only 158 samples, taken in the proportion of one square meter sampled for each 3,465,968 square meters of sea. Or, again, Hensen's estimation, from 120 samples, of the number of certain kinds of fish eggs in a part of the West Baltic; from which, by comparing with the number[2] of such eggs that would normally be produced by the fish captured in that area, he arrived at the conclusion that the fisherman catches about one fourth of the total fish population—possibly a correct approximation, though differing considerably from estimates that have been made for the North Sea.

Such generalizations are most attractive, and if it can be established that they are based upon sufficiently reliable data, their practical utility to man in connection with sea-fishery legislation may be very great. But the comparatively small number of the samples, and the observed irregularity in the distribution of the plankton (containing, for example, the fish eggs) over wide areas, such as the North Sea, leave the impression that further observations are required before such conclusions can be accepted as established.

Of the criticisms that have appeared in Germany, in the United States and elsewhere, the two most fundamental are: (1) That the samples are inadequate; and (2) that there is no such constancy and regularity in distribution as Hensen and some others have supposed. It has been shown by Kofoid, by Lohmann and by others that there are imperfections in the methods which were not at first realized, and that under some circumstances anything from 50 to 98 per cent. of the more minute organisms of the plankton may escape capture by the finest silk quantitative nets. The mesh of the silk is one two-hundredths inch across, but many of the organisms are only one three-thousandths inch in diameter, and so can readily escape.

[Examples shown.]

Other methods have been devised to supplement the Hensen nets, such as the filtering of water pumped up through hose-pipes let down to known depths, and also the microscopic examination in the laboratory of the centrifuged contents of comparatively small samples of water obtained by means of closing water-bottles from various zones in the ocean. But even if deficiencies in the nets be thus made good by supplementary methods, and be allowed for in the calculations, there still remains the second and more fundamental source of error, namely, unequal distribution of the organisms in the water; and in regard to this a large amount of evidence has now been accumulated, since the time when Darwin, during the voyage of the *Beagle* on March 18, 1832, noticed off the coast of South

[2] It is probable that too high a figure was taken for this.

America vast tracts of water discolored by the minute floating Alga, *Trichodesmium erythræum*, which is said to have given its name to the Red Sea, and which Captain Cook's sailors in the previous century called "sea-sawdust." Many other naturalists since have seen the same phenomenon, caused both by this and by other organisms. It must be of common occurrence, and is wide-spread in the oceans, and it will be admitted that a quantitative net hauled vertically through such a *Trichodesmium* bank would give entirely different results from a haul taken, it might be, only a mile or two away, in water under, so far as can be determined, the same physical conditions, but free from *Trichodesmium*. [Illustrations shown.]

Nine nations bordering the northwest seas of Europe, some seven or eight years ago, engaged in a joint scheme of biological and hydrographical investigation, mainly in the North Sea, with the declared object of throwing light upon fundamental facts bearing on the economic problems of the fisheries. One important part of their program was to test the quantity, distribution and variation of the plankton by means of periodic observations undertaken four times in the year (February, May, August and November) at certain fixed points in the sea. Many biologists considered that these periods were too few and the chosen stations too far apart to give reliable results. It is possible that even the original promoters of the scheme would now share that view, and the opinion has recently been published by the American planktologist, C. A. Kofoid—than whom no one is better entitled, from his own detailed and exact work, to express an authoritative verdict—that certain recent observations "can but reveal the futility of the plankton program of the international commission for the investigation of the sea. The quarterly examinations of this program will, doubtless, yield some facts of value, but they are truly inadequate to give any reliable view of the amount and course of plankton production in the sea."[3] That is the latest pronouncement on the subject, made by a neighbor of yours to the south, who has probably devoted more time and care to detailed plankton studies than any one else on this continent.

[Examples were shown of very diversified plankton hauls from neighboring localities on the same date, or from the same locality on adjacent days, to illustrate irregularity in distribution.]

It is evident from such results that before we can base far-reaching generalizations upon our plankton samples, a minute study of the distribution of life in both marine and fresh waters at very frequent intervals throughout the year should be undertaken. Kofoid has made such a minute study of the lakes and streams of Illinois, and similar intensive work is now being carried out at several localities in Europe.

Too little attention has been paid in the past to the distribution of many animals *in swarms*, some parts of the sea being crowded and neighboring parts being destitute of such forms, and this not merely round coasts and in the narrow seas, but also in the open ocean. For example, some species of Copepoda and other small crustacea occur notably in dense crowds, and are not universally distributed. This is true also of some of the Diatoms, and also of larger organisms. Many naturalists have remarked upon the banks of *Trichodesmium*, of Medusæ and Siphonophora, of Salpæ, of Pteropods, of peridinians and of other common constituents of the plankton. Cleve's classification into tricho-plankton (arctic), styli-plankton (temperate) and

[3] *Internationale Revue der Hydrobiologie und Hydrographie*, Vol. I., p. 846, December, 1908.

desmo-plankton (tropical) depends upon the existence of such vast swarms of particular organisms in masses of water coming into the North Atlantic from different sources.

It is possible that in some parts of the ocean, far from land, the plankton may be distributed with the uniformity supposed by Hensen. It is important to recognize that at least three classes of locality exist in the sea in relation to distribution of plankton:

1. There are estuaries and coastal waters where there are usually strong tidal and other local currents, with rapid changes of conditions, and where the plankton is largely influenced by its proximity to land.

2. There are considerable sea areas, such as the center of the North Sea and the center of the Irish Sea, where the plankton is removed from coastal conditions, but is influenced by various factors which cause great irregularity in its distribution. These are the localities[4] of the greatest economic importance to man, and to which attention should especially be directed.

3. There are large oceanic areas in which there may be uniformity of conditions, but it ought to be recognized that such regions are not those in which the plankton is of most importance to men. The great fisheries of the world, such as those of the North Sea, the cod fishery in Norway and those on the Newfoundland Banks, are not in mid-ocean, but are in areas round the continents, where the plankton is irregular in its distribution.

As an example of a locality of the second type, showing seasonal, horizontal and vertical differences in the distribution of the plankton, we may take the center of the Irish Sea, off the south end of the Isle of Man. Here, as in other localities which have been investigated, the phyto-plankton is found to increase greatly about the time of the vernal equinox, so as to cause a maximum, largely composed of diatoms, at a period ranging from the end of March to some time in May—this year to May 28, in the Irish Sea. Towards the end of this period the eggs of most of the edible fishes are hatching as larvæ.

[Statistics and diagrams showing this maximum for the last three years were exhibited.]

This diatom maximum is followed by an increase in the Copepoda (minute crustacea), which lasts for a considerable time during the early summer; and as the fish larvæ and the Copepoda increase there is a rapid falling off in diatoms. Less marked maxima of both diatoms and Copepoda may occur again about the time of the autumnal equinox. These two groups—the diatoms and the Copepoda—are the most important economic constituents in the plankton. A few examples showing their importance to man may be given: Man eats the oyster and the American clam, and these shell-fish feed upon diatoms. Man feeds upon the cod, which in its turn may feed on the whiting, and that on the sprat, and the sprat on Copepoda, while the Copepoda feed upon peridinians and diatoms; or the cod may feed upon crabs, which in turn eat "worms," and these feed upon smaller forms which are nourished by the diatoms. Or, again, man eats the mackerel, which may feed upon young herring, and these upon Copepoda, and the Copepoda again upon diatoms. All such chains of food matters from the sea seem to bring one through the Copepoda to the diatoms, which may be regarded as the ultimate "producers" of food in the ocean. Thus our living food from the waters of the globe may be said to be the diatoms and

[4] See Dakin, *Trans. Biol. Soc. Liverpool*, XXII., p. 544.

other microscopic organisms as much as the fishes.

Two years ago, at the Leicester meeting of the British Association, I showed that if an intensive study of a small area be made, hauls being taken not once a quarter or once a month, but at the rate of ten or twelve a day, abundant evidence will be obtained as to: (1) variations in the distribution of the organisms, and (2) irregularities in the action of the nets. [Examples shown.] Great care is necessary in order to ensure that hauls intended for comparison are really comparable. Two years' additional work since in the same locality, off the south end of the Isle of Man, has only confirmed these results, viz., that the plankton is liable to be very unequally distributed over the depths, the localities and the dates. One net may encounter a swarm of organisms which a neighboring net escapes, and a sample taken on one day may be very different in quantity from a sample taken under the same conditions next day. If an observer were to take quarterly, or even monthly, samples of the plankton, he might obtain very different results, according to the date of his visit. For example, on three successive weeks about the end of September he might find evidence for as many different far-reaching views as to the composition of the plankton in that part of the Irish Sea. Consequently, hauls taken many miles apart and repeated only at intervals of months can scarcely give any sure foundation for calculations as to the population of wide sea areas. It seems, from our present knowledge, that uniform hydrographic conditions do not determine a uniform distribution of plankton.

[Some statistics of hauls shown.]

These conclusions need not lead us to be discouraged as to the ultimate success of scientific methods in solving world-wide plankton and fisheries problems, but they suggest that it might be wise to secure by detailed local work a firm foundation upon which to build, and to ascertain more accurately the representative value of our samples before we base conclusions upon them.

I do not doubt that in limited, circumscribed areas of water, in the case of organisms that reproduce with great rapidity, the plankton becomes more uniformly distributed, and a comparatively small number of samples may then be fairly representative of the whole. That is probably more or less the case with fresh-water lakes; and I have noticed it in Port Erin Bay in the case of diatoms. In spring, and again in autumn, when suitable weather occurs, as it did two years ago at the end of September, the diatoms may increase enormously, and in such circumstances they seem to be very evenly spread over all parts and to pervade the water to some depth; but that is emphatically *not* the case with the Copepoda and other constituents of the plankton, and it was not the case even with the diatoms during the succeeding year.

I have published elsewhere an observation that showed very definite limitation of a large shoal of crab *Zoëas,* so that none were present in one net while in another adjacent haul they multiplied several times the bulk of the catch and introduced a new animal in enormous numbers. [Diagrams shown.] Had two expeditions taken samples that evening at what might well be considered as the same station, but a few hundred yards apart, they might have arrived at very different conclusions as to the constitution of the plankton in that part of the ocean.

It is possible to obtain a great deal of interesting information in regard to the "hylokinesis" of the sea without attempt-

ing a numerical accuracy which is not yet attainable. The details of measurement of catches and of computations of organisms become useless, and the exact figures are non-significant, if the hauls from which they are derived are not really comparable with one another and the samples obtained are not adequately representative of nature. If the stations are so far apart and the dates are so distant that the samples represent little more than themselves, if the observations are liable to be affected by any incidental factor which does not apply to the entire area, then the results may be so erroneous as to be useless, or worse than useless, since they may lead to deceptive conclusions. It is obvious that we must make an intensive study of small areas before we draw conclusions in regard to relatively large regions, such as the North Sea or the Atlantic Ocean. Our plankton methods are not yet accurate enough to permit of conclusions being drawn as to the number of any species in the sea.

The factors causing the seasonal and other variations in the plankton already pointed out may be grouped under three heads, as follows: (1) The sequence of the stages in the normal life history of the different organisms; (2) irregularities introduced by the interactions of the different organisms; (3) more or less periodic abnormalities in either time or abundance caused by the physical changes in the sea, which may be grouped together as "weather."

[Illustrated by diagrams.]

These are all obvious factors in the problem, and the constitution of the plankton from time to time throughout the year must be due to their interaction. The difficulty is to disengage them from one another, so as to determine the action of each separately.

Amongst the physical conditions coming under the third heading, the temperature of the sea is usually given a very prominent place. There is only time to allude here to one aspect of this matter.

It is often said that tropical and subtropical seas are relatively poor in plankton, while the colder polar regions are rich. In fishing plankton continuously across the Atlantic it is easy from the collections alone to tell when the ship passes from the warmer Gulf Stream area into the colder Labrador current. This is the reverse of what we find on land, where luxuriant vegetation and abundance of animal life are characteristic of the tropics in contrast to the bare and comparatively lifeless condition of the arctic regions. Brandt has made the ingenious suggestion that the explanation of this phenomenon is that the higher temperature in tropical seas favors the action of denitrifying bacteria, which therefore flourish to such an extent in tropical waters as to seriously diminish the supply of nitrogen food and so limit the production of plankton. Loeb,[5] on the other hand, has recently revived the view of Murray, that the low temperature in arctic waters so reduces the rate of all metabolic processes, and increases the length of life, that we have in the more abundant plankton of the colder waters several generations living on side by side, whereas in the tropics with more rapid metabolism they would have died and disappeared. The temperature of the sea-water, however, appears to have little or no effect in determining the great vernal maximum of phyto-plankton.

Considering the facts of photosynthesis, there is much to be said in favor of the view that the development and possibly also the larger movements of the plankton

[5] "Darwin and Modern Science" (Cambridge. 1909), p. 247.

are influenced by the amount of sunlight, quite apart from any temperature effect.

Bullen[6] showed the correlation in 1903–7 between the mackerel catches in May and the amount of copepod plankton in the same sea. The food of these Copepoda has been shown by Dakin to be largely phyto-plankton; and Allen has lately[7] correlated the average mackerel catch per boat in May with the hours of sunshine in the previous quarter of the year [curves shown], thus establishing the following connection between the food of man and the weather: Mackerel—Copepoda—diatoms—sunshine. One more example of the influence of light may be given. Kofoid has shown that the plankton of the Illinois River has certain twenty-nine day pulses, which are apparently related to the lunar phases, the plankton maxima lagging about six days behind the times of full moon. The light from the sun is said to be 618,000 times as bright as that from the full moon; but the amount of solar energy derived from the moon is sufficient, we are told, to appreciably affect photosynthesis in the phyto-plankton. The effectiveness of the moon in this photosynthesis is said to be to that of the sun as two to nine, and if that is so, Kofoid is probably justified in his contention that at the time of full moon the additional light available has a marked effect upon the development of the phyto-plankton.

As on land, so in the sea, all animals ultimately depend upon plants for their food. The plants are the producers and the animals the consumers in nature, and the pastures of the sea, as Sir John Murray pointed out long ago, are no less real and no less necessary than those of the land. Most of the fish which man uses as food spawn in the sea at such a time that the young fry are hatched when the spring diatoms abound, and the phyto-plankton is followed in summer by the zoo-plankton (such as Copepoda), upon which the rather larger but still immature food fishes subsist. Consequently the cause of the great vernal maximum of diatoms is one of the most practical of world problems, and many investigators have dealt with it in recent years. Murray first suggested that the meadows of the sea, like the meadows of the land, start to grow in spring simply as a result of the longer days and the notable increase in sunlight. Brandt has put forward the view that the quantity of phyto-plankton in a given layer of surface water is in direct relation to the quantity of nutritive matters dissolved in that layer. Thus the actual quantity present of the substance—carbon, nitrogen, silica, or whatever it may be—that is first used up determines the quantity of the phyto-plankton. Nathansohn in a recent paper[8] contends that what Brandt supposes never really happens; that the phyto-plankton never uses up any food constituent, and that it develops just such a rate of reproduction as will compensate for the destruction to which it is subjected. This destruction he holds is due to two causes: currents carrying the diatoms to unfavorable zones or localities, and the animals of the plankton which feed on them. The quantity of phyto-plankton present in a sea will then depend upon the balancing of the two antagonistic processes—the reproduction of the diatoms and their destruction. We still require to know their rate of reproduction and the amount of the destruction. It has been calculated that one of these minute forms, less than the head of a pin, dividing into two at its normal rate of five times in the day, would at the end of a month form a mass of living mat-

[6] *M. B. A. Journ.*, VIII., 269.

[7] *Ibid.*, VII., 394.

[8] *Monaco Bulletin*, No. 140.

ter a million times as big as the sun. The destruction that keeps such a rate of reproduction in check must be equally astonishing. It is claimed that the *Valdivia* results, and observations made since show that the most abundant plankton is where the surface water is mixed with deeper layers by rising currents. Nathansohn, while finding that the hour of the day has no effect on his results, considers that the development of the phyto-plankton corresponds closely with evidence of vertical circulation. Like some other workers, he emphasizes the necessity of continuous intensive work in one locality; such work might well be carried on both at some point on your great lakes and also on your Atlantic coast. The *Challenger* and other great exploring expeditions forty years ago opened up problems of oceanography, but such work from vessels passing rapidly from place to place could not solve our present problems—the future lies with the naturalists at biological stations working continuously in the same locality the year round.

The problems are most complex, and may vary in different localities—for example, there seem to be two kinds of diatom maxima found by Nathansohn in the Mediterranean, one of *Chætoceros* due to the afflux of water from the coast, and one of *Rhizosolenia calcaravis,* due to a vertical circulation bringing up deeper layers of water. As a local example of the importance of the diatoms in the plankton to man, let me remind you that they form the main food of your very estimable American clam. The figures I now show, and some of the examples I am taking, are from the excellent work done on your own coasts in connection with fisheries and plankton by Professor Edward Prince and Professor Ramsay Wright and their fellow workers at the Canadian biological station, on your eastern seaboard.

The same principles and series of facts could be illustrated from the inland waters. Your great lakes periodically show plankton maxima, which must be of vast importance in nourishing animals and eventually the fishes used by man. Your geologists have shown that Manitoba was in post-glacial times occupied by the vast Lake Agassiz, with an estimated area of 110,000 square miles; and while the sediments of the extinct lake form your celebrated wheat-fields, supplying food to the nations, the shrunken remains of the water still yield, it is said, the greatest fresh-water fisheries in the world. See to it that nothing is done to further reduce this valuable source of food! Quoting from your neighbors to the south, we find that the Illinois fisheries yield at the rate of a pound a day throughout the year of cheap and desirable food to about 80,000 people—equivalent to one meal of fish a day for a quarter of a million people.

Your excellent "whitefish" alone has yielded, I see, in recent years over 5,000,000 pounds in a year; and all scientific men who have considered fishery questions will note with approval that all your fishing operations are now carried on under regulations of the Dominion government, and that fish hatcheries have been established on several of your great lakes, which will, along with the necessary restrictions, form, it may be hoped, an effective safeguard against depletion. Much still remains to be done, however, in the way of detailed investigation and scientific exploitation. The German institutes for pond-culture show what can be done by scientific methods to increase the supply of food-fishes from fresh waters. It has been shown in European seas that the mass of living food matters produced from the uncultivated water may equal that yielded by cultivated land. When aquiculture is as scientific as

agriculture your regulated and cultivated waters, both inland and marine, may prove to be more productive even than the great wheat lands of Manitoba.

Inland waters may be put to many uses: sometimes they are utilized as sewage outlets for great cities, sometimes they are converted into commercial highways, or they may become restricted because of the reclamation of fertile bottom-lands. All these may be good and necessary developments, or any one of them may be obviously best under the circumstances; but, in promoting any such schemes, due regard should always be paid to the importance and promise of natural waters as a perpetual source of cheap and healthful food for the people of the country.

W. A. HERDMAN

REFORM IN SYDNEY UNIVERSITY

CONSIDERABLE agitation has been going on for several years in New South Wales for a reform in the constitution and policy of the University of Sydney, and this unrest has at last taken the definite shape of a bill before the legislature of the state. The University of Sydney, founded in the early fifties, can boast of as antiquated a system of government as if it had been in operation for five hundred years. It is governed by a senate, a body corporate consisting of sixteen members who are elected and have a life tenure of office. It pursues a conservative and exclusive policy, making no allowances for the difference between British and Australian conditions. Where there are many colleges, as in America, there is little to be apprehended from the oligarchical government of a few; but where there is but one, as in New South Wales, with a practical monopoly of higher education, the absence of any democratic or social adaptation is severely felt. Sydney University does not employ Australian professors and does not teach Australian subjects beyond necessity. The minor lecturers are Australians who have won the highest honors at home and abroad, but they are not allowed to aspire to the title and office of a professor. A British committee that had been requested to make nominations for a vacant chair recently nominated an Australian, whose name was rejected by the senate in favor of the man named by the committee as its second choice. The second nominee declined in order to show his disapproval of the proceeding, and a third choice became necessary. Again, Australian literature and history offer an attractive harvest, but they are not taught by the University of Sydney; Australian economics fares no better, and the local Australian spirit is not understood.

The amending bill is extremely moderate in its provisions for reform, and by no means satisfies the radical or national party, which in Australia is for practical purposes the labor party. It provides that the government's annual appropriation towards the revenues of Sydney University shall be increased from £10,000 to £20,000; that chairs of agriculture and veterinary science shall be established, the latter chair having been already filled by arrangement between the government and the university; that the fees of students shall be reduced; that the tenure of office of members of the senate shall be limited to eight years, four to retire at the first election and four more every second year until the whole constitution of the body is changed; and finally that the electors shall vote by letter, and that every graduate of the institution over the age of twenty-one years shall be entitled to vote.

It is probable that the present amending bill is but a step in the direction of state absorption of the university. Whatever may be best elsewhere, this is what is needed in Australia. At the same time, it is not to be forgotten that Sydney University has always maintained a high standard of scholarship and efficiency within its aims; that the average salary of its professors is over a thousand pounds a year, representing a higher rate of payment than that of the best of American universities; that in 1907 it had 1,165 matriculated students; that its staff consisted in that year of 15 professors and 68 lecturers, of whom

a number of the lecturers are paid on a level with adjunct professors in America; and that the year's expenditure was £50,298, of which sum £13,750 was granted by the government of the state. But for all that, the University of Sydney is not as accessible, not as democratic, not as national as a seat of higher education should be in the youngest of the world's great countries.

PERCIVAL R. COLE

TEACHERS COLLEGE,
COLUMBIA UNIVERSITY

T. NISHIKAWA, 1874–1909

WE regret to record the death of Dr. Tokichi Nishikawa, of Tokyo, one of the most promising of the younger generation of Japanese zoologists. He had been for a number of years an associate of Dr. Kishinouyé in the Imperial Fisheries Bureau in Tokyo, and he was later a special investigator of pearls. In his studies of the latter he traveled extensively and was at one time commissioned by the Japanese government to report upon the great pearl fisheries of the South Seas. He is distinguished as the discoverer of a process by which the pearl oyster may be caused to secrete spherical pearls. Before this only hemispherical pearls had been produced, in spite of centuries of experimentation, especially in the orient. Dr. Nishikawa devoted nearly ten years to his studies on producing pearls, and achieved success only in the days of his final illness. In his memory, and in token of the importance of his discovery, a number of his living pearl oysters were brought to the University of Tokyo on the occasion of the commencement exercises: they were opened in the presence of the emperor, and Professor Iijima demonstrated that their mantles had secreted spherical pearls.

The publications of Dr. Nishikawa include important contributions to our knowledge of Japanese fishes, structural, systematic, embryological. Especially to be recalled is his pioneer paper on the development of the remarkable frilled shark, *Chlamydoselachus anguineus.*

BASHFORD DEAN

THE AMERICAN SOCIETY OF ZOOLOGISTS

THE annual meeting of the Eastern Branch of the American Society of Zoologists will be held at Boston, Massachusetts, on December 28, 29 and 30, 1909.

Members of the society are urged to send the titles of their papers to the secretary not later than December 1, so that a preliminary program may be issued about December 10. It will be necessary to place the papers received after that date at the end of the list.

Nominations for membership, accompanied by full statements of the qualifications of the candidates, must be in the hands of the secretary before December 1, in order that the list may be submitted to the executive committee of each branch before the meeting.

LORANDE LOSS WOODRUFF,
Secretary

YALE UNIVERSITY

SCIENTIFIC NOTES AND NEWS

AT the recent meeting of the Board of Trustees of the Carnegie Foundation for the Advancement of Teaching, Dr. Ira Remsen, president of Johns Hopkins University, and Dr. Charles R. Van Hise, of the University of Wisconsin, were elected trustees to fill vacancies caused by the resignations of Dr. Charles W. Eliot, of Harvard University, and Dr. E. H. Hughes, of De Pauw University. Provost Charles E. Harrison, of the University of Pennsylvania, was elected chairman of the board to fill the vacancy caused by the retirement of Dr. Eliot.

PROFESSOR FRANZ WEIDENREICH, of Strassburg, has accepted the invitation of the Association of American Anatomists to participate in the meeting during convocation of this year, and to deliver an address on the development, morphology and clinical relations of the blood. His own researches in this field have been of the highest importance, and have done more to clear up the subject and to free it from the intricate confusion created by purely clinical writers than any other work of recent years. The address will be followed by a demonstration of preparations, many of which are the results of new methods

devised by Professor Weidenreich. It is to be hoped that a precedent will be established by this event, and that hereafter there will be annually specially invited foreign guests, whose presence and communications will add much to the profitableness of our annual scientific gatherings.

KING EDWARD has conferred the order of the Indian Empire on Dr. Sven Hedin, the distinguished Swedish geographer and traveler.

A KNIGHTHOOD has been conferred on Professor W. A. Tilden, F.R.S., professor of chemistry and now dean of the Royal College of Science, London.

PROFESSOR JULIUS KUHN has retired from the directorship of the Agricultural Institute of the University of Halle, and is succeeded by Professor Wohltmann.

DR. JAMES JOHNSTON DOBBIE, F.R.S., director of the Royal Scottish Museum, Edinburgh, has been appointed principal chemist of the British Government Laboratories, in the place of Sir T. E. Thorpe, who has retired.

AT the Berlin Meteorological Institute, Professor Kassner has been promoted to chief of department and Dr. Henze succeeds him as observer.

MR. C. L. WILLOUGHBY, dairyman and animal pathologist to the Georgia Experiment Station, has resigned.

DR. A. M. TOZZER, of the department of American archeology and ethnology of Harvard University, is in charge of an expedition for research in Central America and British Honduras on behalf of the Peabody Museum.

THE *Bulletin* of the American Geographical Society states that Mr. Ellsworth Huntington, of Yale University, returned home early in October, after a profitable journey of eight months. After exploring the Dead Sea he made expeditions into the wild border regions of the Syrian Desert, the Negeb or South Country, the Druze Mountains and the Leja with its volcanic flows and went as far as Palmyra and northern Syria. Throughout the journey, special attention was paid to climatic problems, and it was found that the phenomena of Palestine agree with those of Central Asia in a remarkable degree. In early July, Mr. Huntington went up to Asia Minor by way of the Cilician Palin and the city of Adana. The months of July and August were devoted to a study of the lakes of Central Asia Minor. On the way home from Turkey a flying visit was paid to Greece. A study of the alluvial deposits which cover the Olympian plain and from the midst of which old Olympia has been excavated, yielded evidence of the manner in which the climatic history of Greece has been parallel to that of regions 2,000 or 3,000 miles farther east.

MR. H. H. TURNER, Savilian professor of astronomy at Oxford University, gave a public lecture on November 23, on "Possible Evidence on having reached the North Pole."

THE Bradshaw lecture of the Royal College of Surgeons will be delivered by Mr. F. Richardson Cross on December 10, on "The Brain Structures concerned in Vision, and the Visual Field."

THE inaugural meeting of the Illuminating Engineering Society was held at the Society of Arts, London, on November 18, when an address was delivered by Professor Sylvanus P. Thompson, the first president.

WE learn from the *Journal* of the American Medical Association that the monument raised by international subscription to Professor Jules Liégeois, was unveiled on October 24 at Damvillers, department of the Meuse, his native city. The monument consists of a bust and is on a granite pedestal in the center of the public square of the city hall. Besides an official delegation from the University of Nancy, other French and foreign scientific men were present at this tribute to the memory of the first juris-consult who studied the relation of hypnotism and suggestion to criminal law and legal medicine.

THE Rev. W. H. Dallinger, D.Sc., F.R.S., the well-known microscopist and biologist, died at Lee, England, on November 7, aged sixty-seven years.

Dr. Georg N. Zlatarski, professor of geology at the University of Sophia, has died at the age of fifty-six years.

The statement in Science, page 706, that "By an arrangement with the Central Stelle, Kiel, the Lowell Observatory has been made the telegraphic distributing center for planetary news in America," has very naturally been taken to mean that *all* announcements concerning planets are to be distributed by the Lowell Observatory, instead of the Harvard College Observatory as heretofore. The published announcement of the Central Stelle in the *Vierteljahrsschrift* (44 Jahrgang, p. 236), is that the arrangement refers merely to *changes on the surfaces* of the planets. No change has been made in the plans of the Harvard College Observatory for the transmission of astronomical announcements. All announcements of astronomical discoveries and observations received, which are of value and require immediate transmission, are cabled at once to Kiel, and telegraphed at cost to all who desire to receive them. A similar distribution of these messages, and of others in which haste is not imperative, is made by mail, without charge, to those who make use of them.

Two of the special features of interest to industrial chemists at the winter meeting of the American Chemical Society will be a symposium on the chemistry and technology of paint and a special sectional meeting to discuss the chemistry of india rubber. The former will be held as a part of the program of the industrial division under the chairmanship of A. D. Little, 93 Broad St., Boston, while the Section on Rubber Chemistry will be in charge of Harold van der Linde, 111 Broadway, New York City.

The twenty-fifth meeting of the Indiana Academy of Science will be held at Indianapolis, November 25–27, 1909, under the presidency of Dr. A. L. Foley, of Indiana University. The committee to arrange for this anniversary meeting is M. B. Thomas, Crawfordsville; W. E. Stone, Lafayette; C. L. Mees, Terre Haute; W. J. Moenkhaus, Bloomington; H. L. Bruner, Indianapolis; J. P. Naylor, Greencastle, and Amos W. Butler, Indianapolis, chairman. It is planned to have papers and addresses specially suitable for this occasion from several of the older members who have removed from Indiana. These include John M. Coulter, University of Chicago; David Starr Jordan, Leland Stanford Junior University; Harvey W. Wiley, U. S. Chemist; W. A. Noyes, University of Illinois; C. A. Waldo, Washington University, St. Louis; who have each served as its president, and Barton W. Evermann, U. S. Fish Commission; D. T. MacDougal, Desert Laboratory, Arizona; H. A. Huston, Chicago; A. H. Purdue, University of Arkansas; Charles W. Greene, University of Missouri. The sessions will be held in the Claypool Hotel, which will be headquarters. A banquet will be given there on Friday night to the distinguished guests. Governor Thomas R. Marshall will be present and David W. Dennis, of Earlham College, one of the charter members and a former president, will be toastmaster.

According to a report of the Forest Service, Washington, Louisiana, Mississippi, Arkansas and Wisconsin, in the order named, lead in producing the country's lumber supply whose valuation for last year exceeds $500,000,000. Texas, Michigan, Oregon, Minnesota and Pennsylvania came after the first five states and others followed in decreasing amounts down to Utah, the lowest on the list, with Nevada and North Dakota, having little timbered area, not rated at all. Yellow pine of the south which has been far in the lead in the lumber production for more than a decade, more than maintained its supremacy last year, contributing slightly more than thirty-three per cent. of the total cut from all kinds. Douglas fir, of the northwest, ranked second, and white pine third. Practically all kinds showed a marked decreased cut, and for the first three kinds of timber there was a falling off of fifteen, twenty-two and twenty per cent., respectively. Oak and hemlock maintained their relative ranks but showed decreases of twenty-five per cent. each in amount produced, and spruce dropped eighteen per cent. Louisiana was the heaviest

producer of yellow pine lumber, supplying nearly one fifth of the total production. Texas, Mississippi, Arkansas and Alabama followed in the order named. The state of Washington, alone, supplied more than three fifths of the Douglas fir cut, while the bulk of the remainder came from Oregon. Minnesota produced about a third of the white pine, followed by Wisconsin with about fifteen per cent. and New Hampshire with ten per cent. An interesting feature of the report is that two New England states, Maine and Massachusetts, produced more white pine than Michigan, which for many years led the country in producing this valuable timber. Oak lumber manufacture now centers in Kentucky, West Virginia and Tennessee. Wisconsin comes first in the production of hemlock, taking the position held by Pennsylvania for so many years.

THE London *Times* reports that a novel method of killing moths and other insects which are harmful to grape-vines has been adopted near Rheims. Posts supporting 5-candle-power electric lamps were placed in the vineyards, from each of which a dish, containing water with a top layer of petroleum, was suspended. During the first night these traps were placed in three parallel rows at distances of about 200 feet from each other, the distance between each lamp being about 75 feet. On the first clear evening late in July the current was turned on about eight o'clock, and the lamps remained burning until an hour or so after midnight. Soon after the lamps were lighted the insects swarmed towards them and were rapidly killed, either by the fumes of the petroleum or by the petroleum itself. The same operation was resumed the next clear night, but the lamps of the two outside rows were placed about 25 feet closer to those of the center row, and this was repeated in each of five subsequent clear nights, so as finally to bring the three rows within about 50 feet of each other. During the succeeding six or seven clear nights the movement was reversed in the same manner, so as to return the lamps to their position of the first night. As to the position of the lamps, numerous experiments were made during these trials, and it was proved that the greatest number of insects were killed when the petroleum dish was elevated only a few inches above the ground. These experiments were witnessed by representatives from a number of leading champagne makers, and this method was recommended to all wine growers who can avail themselves of the services of electricity.

THE Norwegian government has placed the steamship *Michael Sars* at the disposal of Sir John Murray and Dr. Hjort, the Norwegian Fishery director, for deep-sea exploration in the Atlantic Ocean from the Canary Islands to the Faroës. According to the London *Times* the purpose of the cruise is to try in the great ocean the new methods and instruments which have been developed within the past few years, especially during the International Fishery Explorations. It is believed that the great fishery nets and trawls which are now used for economic purposes in shallower waters can be used with success in great depths, down even to three and a half miles. On one occasion the *Challenger*, from a depth of nearly two miles, with a ten-foot trawl, brought up 27 fish belonging to seven species, but recently the *Michael Sars*, by means of a trawl with fifty-foot headrope, brought up from a depth of over half a mile 225 fish, 100 of which belonged to new species. If these larger catching appliances can be used with success in the greatest depths of the Atlantic, some important and interesting zoological results may be obtained. Special interest will be attached to observations with Ekman's new current-meter. This has been used with success by the *Michael Sars* down to depths of 200 fathoms. An attempt will be made by means of this current-meter to measure the rate of currents over oceanic shoals, Buchanan having shown that tidal and other currents are well marked over the Dacia bank in mid-ocean, off the coast of Africa. It may even be possible to have records by this instrument in very deep water, where our knowledge of currents is at present almost *nil*. Attempts will be made to force long tubes into the oceanic deposits, with the view of getting sec-

tions of considerable depth and ascertaining if there be layers differing in composition. At the present time we know nothing about the depth of marine deposits beyond eighteen inches. The *Michael Sars* will leave Plymouth about April 6. A series of sections will be made from the coasts of Europe over the continental slope into deep water as far south as Gibraltar, and even off the coast of Africa as far south as Mogador. Observing stations will then be made as far as Madeira and the Azores. Should good weather be encountered, she may then proceed to Newfoundland, Iceland, the Faröes and Scotland. Should, however, the weather not permit this extended cruise, the ship will return again along the coasts of Europe to the Faröe Islands. Sir John Murray, Dr. Johan Hjort, Professor Gran, Dr. Helland-Hansen and Mr. Koefoed will take part in the expedition. Captain Tversen has been in command of the ship for the past seven years, and the crew are experienced in deep-sea work.

UNIVERSITY AND EDUCATIONAL NEWS

The Board of Trustees of the Reed Institute will establish at Portland, Ore., a College of Arts and Sciences, with the bequest of $2,000,000 left by the late Mrs. Amanda W. Reed.

Senator Guggenheim, of Colorado, has undertaken to give buildings to the State Agricultural College and to the State Normal School. It will be remembered that Senator Guggenheim has recently given valuable buildings to the University of Colorado and the State School of Mines.

Announcement is made that the Yale corporation has decided to place the new Sloane Physical Laboratory on the Hillhouse property, two blocks north of the new Sheffield campus. Mr. Charles C. Haight, who has been the architect for the Vanderbilt dormitories, the university library and Phelps Hall, has been chosen as architect.

Forty-seven Chinese students have come to this country to enter different colleges at the expense of the Chinese government. They will be followed next year by 153 students, and the 200 students will be educated in this country with the indemnity growing out of the Boxer troubles and returned by our government to China. The whole sum will be devoted to educational work. Students will be sent from China after earning appointments by competitive examinations. Each student is to study five years in American schools. The students are in charge of Tong Kwoh On, of the Chinese Foreign Office, a graduate of Yale University.

Dr. G. C. Duncan, recently a Fellow in the Lick Observatory, University of California, has been appointed instructor in astronomy in Harvard University.

Mr. Charles E. Temple, A.B. (Nebraska, 1906), A.M. (1909), has been appointed instructor in botany at the University of Michigan.

Dr. Jules Brady has been appointed assistant professor of diseases of children in the St. Louis University School of Medicine.

Dr. John Wyllie Nicol has been appointed the McCall Anderson Memorial lecturer in dermatology in the University of Glasgow.

DISCUSSION AND CORRESPONDENCE

THE ENDOWMENT OF MEN AND WOMEN, A CHECK TO THE INSTITUTIONAL "EXPLOITATION" OF GENIUS

When rumors of the intention of Mr. Andrew Carnegie to devote a goodly portion of his vast wealth to the encouragement of science first reached the academic world, it was hinted in certain quarters that his benefaction might possibly take the form of endowing men and women rather than institutions. What a few men of science openly, and many more privately, advocated, seemed on the eve of realization. The servitude of the individual investigator to the whims of governing bodies, the gross and petty tyrannies of presidents, and the time-destroying and soul-sickening vanities of faculties, appeared about to end. But the development of the Carnegie Institution, as it now exists, has pushed aside once more the fulfilment of such dreams. Later.

the announcement of the establishment of the Carnegie Foundation for the Advancement of Teaching, with its pensions for teachers in colleges and universities, aroused again hopes that the status of the individual would be significantly and permanently improved, but the policy finally adopted dashed them to the ground. Indeed, it has been argued, with some show of justice, that the Carnegie pensions, far from being a benefit to men of science engaged in academic work, will act as a distinct hindrance, since there are not wanting signs that some institutions are already taking into account these pensions when fixing or advancing salaries. Thus, it may happen that the provision intended to benefit the professor, when worn out by investigation and teaching, or his widow, when he is dead, will actually serve as a means of keeping down his salary while alive and rendering the best service possible. Only those who are to be "benefited" can appreciate to the full the crushing effect of such a procedure. "He'll get a Carnegie pension, anyway, when his time comes!" What a miserable philosophy of academic life those words can cover! The exploitation, in this way, by institutions of investigators and teachers still in their prime, or in the best days of their youth, is a sin too heinous to be quite covered by the charity-mantle of an old-age pension. The possibilities here for "graft" at the expense of manhood and womanhood are as dangerous and degrading as anywhere in the realm of politics. The authorities of the Carnegie Foundation must see to it that the selection of "picked young men" and their retention as cheaply as possible will remove the institution indulging in such practises from the sphere of its benefits. Much could be done at their initiative to make the hire worthy of the laborer. That in any profession or department of service to mankind advantage should be taken of zeal, devotion and ability on the lowest basis ought to be now impossible. That a young man or a young woman of genius ought to be kept both poor and in leading-strings is neither humane nor evolutionally justifiable. Youth that dares and does ought to be well fed bodily and spiritually. One of the saddest chapters in the history of education deals with the young men and women who have been "exploited" by institutions and then dropped, like a lemon sucked dry, or retained on the staff at starvation wages. For this state of affairs, so unjust to the individual and so corruptive of the best human instincts and ideals, some drastic remedy is needed. The present writer believes that the endowment of men and women and the adoption of the policy that universities are for men, not men for universities, would go far toward relieving the situation and making conditions helpful to individual genius and worthy the dignity of scientific research. Certain independent fellowships of large income in Europe and America illustrate the point; so, likewise, the achievements of endowed men of genius, like Darwin, etc. Some of the things that would result, if such a policy were adopted, may be here briefly outlined.

1. *Health and Rest.*—Endowment of the individual would be of great physical and moral, as well as intellectual, benefit. It would enable the investigator to work in conformity with his own rhythm of rest and activity, and thus largely avoid the risk of bodily or mental break-down. He could also take his sabbatical year when he needed it and not merely when he could get it or beg it. The all-too-common spectacle of a professor (with a family to care for besides himself) reduced to the necessity of recuperating by getting well again on half his salary or even less, would be no more, and the theory ended that a sick man needs less to get well with than a well man to keep well on. Such endowment would protect investigators from summer schools and those other academic fringes that are a burden to body and soul. Hours need not then be wasted arranging man-millinery, rehearsing for academic functions, standing in line, sitting on platforms, marching from building to building, and submitting to the increasing fads and fancies of the American universities. An endowed man would feel his backbone stiffened enough to join the few protesting now and put an end to the subordination of science to the gown and its long train of absurd inconsequentialities made so much

of by many schoolmen; and also the sacrifice of higher education to the fatal alliance of undergraduate and post-graduate instruction. It would also preserve the summer vacation from the inroads of presidents and governing bodies of educational institutions whose ill-concealed (sometimes openly avowed) ideal is often that of an educational factory running all the year round on the schedule of the overseer. It would do much to end the spectacle of the *sanus professor in academia infirma,* and prevent many of the physical and mental break-downs resulting from the atmosphere of colleges and universities so detrimental to the sympathetic development and the sane and reasonable utilization of the genius of the individual. Endowment of the individual would also establish on a firm basis the "sabbatical year," and other needed provisions for prolonging the academic life of the investigator.

2. *The Human Side of Scientific Life.*—Endowment of the individual would go far toward relieving, and, in the end abolishing altogether, the long-existing situation by means of which educational institutions as such have profited at the expense of the family and human social instincts. No more would all grades below that of full professor have attached to them salaries whose size and static character indicate, if not a desire to prevent marriage, a more or less deliberate decision to ignore the new conditions which it creates. The true university must recognize that bachelorhood, while it may be cheaper, is ultimately no real gain to science and that, for the purposes of research, as in every other field of human effort, the best man is he who is most of a man. A university of half-men is but a torso after all. Science should be an aid, not an impediment, to marriage. A man and a woman working together, as far as possible, should be, here, as everywhere else, the ideal condition. No more than any other field of human endeavor can science refuse to do homage to that divine union of man and woman which has been the source of all things good, beautiful and true since the race began. A unisexual science is an evolutional anomaly, the fad of a season, if the season does seem long-drawn out and some of the fashion-makers are the *beatipossidentes* of the educational world. The day of the hermit and the recluse in science is by forever. Humanity can not and will not permit individuals whose aim in life is supposed to be the search after truth and the increase of knowledge, to withdraw themselves absolutely from religious, social and political life. It will see to it that their incomes are sufficient to enable them to be a part of the human world about them and share in its activities, as well as devote themselves to the various subjects of scientific research of which they are the authoritative representatives. This further humanizing of men and women of science would come through the endowment of the individual. Academic freedom of the highest order would have as its correlate a human devotion to the needs of humanity, and the greater the man of science, the greater his interest in, and his contribution to, the solution of the essential problems of human social existence.

For many, if not, indeed, the great majority of professors, exclusive of those who have inherited money, or married wives with incomes of their own, an academic career means loss not only of the reasonable luxuries of life, but also of many of its common enjoyments, and sometimes even of its chief necessities. The treatment of a professor in the matter of office room, stationary and other supplies, secretarial and stenographic assistance, etc., suffers altogether by comparison with similar grades of officials in business houses that are great, but institutions in no wise more important or better off financially than our great universities. It is not uncommon that an instructor or a professor, doing excellent work, and recognized as an authority on his special subject, with a salary hardly sufficient to live upon (at the present moment, *e. g.*, with a purchasing capacity from 25 per cent. to 40 per cent. less than what it had been five or ten years before) has to pay his own expenses to every scientific meeting he attends, write everything he publishes with his own hand, and pay for official letter-heads, envelopes, and even stamps out of his own pocket. Moreover, institutions that allow such things

to go on will often make it necessary for members of the faculty to indulge in high-priced gowns, cater to social conventions, and perform all sorts of extra duties and burdensome functions without the slightest additional compensation. In many cases even evenings and Sundays are not respected, but have constant inroads made upon them. Some of these things may seem petty at times, but they are often quite sufficient to clog genius in all its higher and nobler activities. It is expenditure of energy upon such things and worry about them that not infrequently sap body and brain together. Yet so many heads of educational institutions have not a twinge of conscience as they oversee, year in and year out, genius suffering from such menial tasks.

3. *Discrimination Against Women.*—The endowment of individuals would put an end to the sex-criterion of remuneration for the laborer in the field of science, for men and women could then be paid according to their needs and their abilities and not according to their sex. Women of genius would be given an equal opportunity with men of genius, and the absurd distinctions of salary inherited from the public schools would no longer be a drag upon the scientific work of the university. The woman of science, like the man, would be worthy her hire. No woman seeking advancement in the academic world would need to have her position and her recompense determined by a board of trustees consisting entirely of men or be judged by a man president and professors whose views on the "sphere" of the other sex are almost medieval and whose use for women at a university is merely a sort of psychic polygamy, in which they can be wedded to science without having any real children of their own. It would make women of talent and genius independent of the male-manned faculties so often below them in honor, honesty and devotion to science and scientific ideals.

4. *The Question of Honesty.*—It has been urged by some that endowed men and women could not be trusted to "earn their wages," if they were not under the restraints of the present system. This amounts to saying that the average man or woman of science to be thus endowed is not the equal in honesty and personal integrity of the average college or university president, the average member of a board of trustees or the average member of an educational trust. And every one knows the untruth of such a statement. Professorial honor is just as great as presidential or executorial. A "Lexowing" of educational institutions would not be all to the disadvantage of the professors and to the credit of academic heads and boards of government. Individuals are quite as honest as institutions.

5. *Research and Teaching.*—One of the most wasteful and unjustifiable policies now in vogue in higher education is the imposition upon those engaged in scientific research of mere routine teaching and lecturing. This has killed off many a promising investigator and is responsible to a considerable degree for the surprisingly small output of original ideas and discoveries in certain American educational centers. The endowment of the individual would help much here, where academic freedom of the highest type is so sorely needed. Universities do not hesitate to demand teaching or lecturing of every member of the staff and sometimes the authorities spend time and energy in seeking to increase rather than decrease the hours thus employed. A young man or young woman whom God and nature intended to be a first-class investigator is, by the devices of a president or the demands of a board of trustees, metamorphosed for a good part of the year into a teacher of quite ordinary capacities toiling at hack-work under factory-rules. No surer way of atrophying real genius or killing it outright could possibly be invented. Every fertile hour of invention and production is subject to the deadly interruption of the class-room exercise. Yet it seems to delight so many academic authorities to be able to report that every professor spends his hours of "teaching" every week, whether he has any talent for it or not, or whether every moment thus employed may be a distinct impediment to the effectual exploitation of his genius for scientific research. The true university of the future must guarantee the real investigator

immunity from the infliction of the class-room. Much toward this end can be achieved by endowing the individual and making him free to follow the bent of his genius, refusing to be what he is not or do what he ought not to do; by assuring him that devotion to his real task in life does not mean starvation or the avoidance of human duties and social service altogether.

6. *The Real University.*—The endowment of the individual would make possible the appearance of the real university. Hitherto universities, like colleges, have been the creations and the creatures of one man or set of men, not necessarily scientifically-minded at all. Presidents and boards of trustees, often animated and controlled by religious prejudices, political amenities, social prescriptions, personal bias, etc., have had the power to assemble a heterogeneous body of teachers and investigators, among whom no two, though personally unobjectionable and practically equal in ability or experience, may hold the same title or receive the same salary, constitute them a college, or a university, and, after meeting the necessary legal and other preliminaries, begin the task of educating the youth of the land. Outside of the few that are happily neither, the so-called higher institutions of learning are often trustee-ridden or president-ridden, or both, as is sometimes unfortunately the case. Often the faculties have little or no power of their own, being entirely subordinate to and dictated to at all times by the president or the board of government, or ground between the upper and nether mill stone of both. Such institutions are not genuine universities, but merely places of education after the model of the factory or the local habitations of great trusts. The true university can arise only through the free and spontaneous association of men and women of science, whose movements are subject neither to the personal opinions of a strong president nor to the policies of a board of trustees chosen with absolutely no reference to the advancement of science through research, but merely as approved guardians of a certain amount of money set apart for educational purposes. With the endowment of the individual the fact would be made clear that universities are made for men, not men for universities. It would mean the end of a universitarianism, as evil sometimes in its results as ever was Sabbatarianism of the narrowest sort. The true university must be one of men, not of positions, and the scholar must be honored for his wisdom and knowledge and not for "executive ability" or opportunist skill in getting along with the "powers that be," and thus easily securing the promotion or the increase in salary denied to others not a whit less capable or deserving. This is a consummation devoutly to be wished. And until such real universities arose, endowment of men and women would ensure them a freedom of movement impossible and unprocurable under the present system, where the income of the individual professor is derived from the institution he serves and does not reach him as the meed of his scientific achievements. If the professor himself were endowed, he would have some choice in the matter, and he would not of necessity be compelled to associate himself with a college or a university whose policies he disliked, or with one whose evident purpose was the spectacular exploitation of his scientific genius. He would be able to wait for the "psychological moment," and qualified to seek among the institutions competing for his services the one best suited to his personality, his temperament, his methods of work, and his conceptions of the duties of a man and a man of science. The very fact that he could refuse an academic position and still go on with his investigations would raise the standard of appointments and improve the moral tone of the higher academic life, forcing colleges and universities in their relations with members of their faculties, present and prospective, to abandon the ideal of the factory and reach forward into the atmosphere of model business enterprises of the best type. Promotion unasked, where science and ability justify it, is more in place in a university than it is even in the office of a great railroad company. In this respect it is that not a few of the heads of our great educational institutions fail so lamentably when compared with the great railroad presidents.

They are skilful in picking out young men at small salaries and letting them grow old in the enjoyment of them, but not so great in creating for the best of them the environment most advantageous for their individual development and their productivity for science and human betterment. They utilize talent instead of fostering genius, for which they too often provide an early death that can hardly be termed euthanasia.

The institutional exploitation of genius has been tried long and on a large scale, and it is clearly not a success. Let us give the endowment of the individual as long and as extensive a trial and see what the results will be. Let us have the new university with the new ideals of the value of men of science to education and to human activities and ideals. Let us institute an academic freedom worthy the name!

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THE KUMBAINGGERI, TURRUBUL, KAIABARA AND MYCOOLON TRIBES, AUSTRALIA

IN his "Native Tribes of Southeast Australia," Dr. A. W. Howitt refers to the Kombaingheri tribe (my Kumbainggeri) on the Bellinger River, on the east coast of New South Wales, and after mentioning their four intermarrying divisions, says:

> It is not possible to say how these four subclasses (my sections) are placed in pairs representing the two moieties of the tribe, without which knowledge it can not be said whether descent is in the male or the female line.[1]

Moreover, he places the Kumbainggeri amongst others under a general heading of "Tribes with male descent."

In 1897[2] and again in 1900[3] I published a table of the four intermarrying sections of the Kumbainggeri tribe, showing how the sections are divided into two phratries or cycles, and supplying lists of totems belonging to each cycle. I stated that "the rules of marriage and descent are precisely the same as in the Kamilaroi tribe." I also pointed out that whether a woman of the Womboöng section marries a Kurpoöng or Marroöng husband, her offspring is always Wirroöng. Mr. Edward Palmer had previously, in 1883, reported the four divisions of the Kumbainggeri, but he did not show their classification into phratries or cycles.[4]

The following is a copy of my table above referred to:

Phratry or Cycle	Husband	Wife	Offspring
A	Kurpoöng	Womboöng	Wirroöng
	Marroöng	Wirroöng	Womboöng
B	Wirroöng	Marroöng	Kurpoöng
	Womboöng	Kurpoöng	Marroöng

There are feminine forms of these names, which appear in my table of 1897 and 1900, but they are omitted in the present table, for the sake of simplicity. It was stated in my former papers that Kurpoöng corresponds to Murri, Marroöng to Kubbi, Wirroöng to Ippai, and Womboöng to Kumbo, of the Kamilaroi divisions.

In 1898 I published a detailed account of the Burbung ceremony of initiation practised by the Kumbainggeri tribe with a comprehensive map of their territory.[5] In 1900 I also described a preliminary form of initiation used by the same tribe, known as the Murrawin ceremony.[6] In 1903 I published a grammar and vocabulary of the Kumbainggeri language.[7]

Having therefore been personally engaged in investigations among the Kumbainggeri tribe for a number of years, I am unwilling that Dr. Howitt's assertion that the line of descent can not be given, should go forth uncontradicted, especially as my works already quoted have made it indisputably clear that

[1] *Op. cit.*, pp. 105 and 269.

[2] *Journ. Roy. Soc. N. S. Wales*, XXXI., pp. 169–70.

[3] *Queensland Geographical Journal*, XVI., p. 41.

[4] *Journ. Anthrop. Inst., London*, XIII., p. 304.

[5] *Proc. Amer. Philos. Soc., Phila.*, XXXVII., pp. 54–73, map.

[6] *Queensland Geographical Journal*, XVI., pp. 35–40.

[7] *Mitteil. d. Anthrop. Gesellsch. in Wien*, XXXIII., pp. 321–328.

descent of the sections and totems is counted through the mothers in all cases.

Dr. Howitt reports that the Chepara and Turrubul tribes on the coast from Point Danger to Brisbane and Pine rivers "had no social organization in classes or totems, the regulation of marriage being by locality; and descent of name in the male line."[8] Speaking of the Kaiabara tribe at the Blackall or Bunya Bunya Ranges, he also asserts that "descent is in the male line."[9]

In 1898 I reported that the Turrubul tribe had the four intermarrying divisions, Barrang, Banjoor, Bunda and Derwain, with descent always reckoned on the female side, the children taking the phratry and totem name of their mother. At the same time I also showed that descent in the Kaiabara tribe is through the women and not through the men.[10]

In 1883 Dr. Howitt published a table of the four intermarrying divisions of the Mycoolon tribe on the Cloncurry River, Queensland, and stated that descent was through the father, giving as a reason that "under the influence of agnatic descent the girl is of the same class name as her mother's mother."[11]

In 1898 I contradicted this statement and showed that descent in the Mycoolon tribe is counted through the mother only.[12] Dr. Howitt in his late work, "Native Tribes of Southeast Australia," does not refer to my contradiction, from which it may be inferred that he maintains his statement of 1883. Whether he does so or not, it becomes necessary for me to repeat that I am quite certain that descent in the tribe mentioned is indisputably maternal. It should be mentioned that Mr. E. Palmer had also previously arrived at the same conclusion as myself.[13]

[8] "Native Tribes of Southeast Australia," pp. 136–7.

[9] *Op. cit.*, p. 229.

[10] *Proc. Amer. Philos. Soc.*, XXXVII., pp. 328–31, with map; *Journ. Roy. Soc. N. S. Wales*, XXXII., pp. 81–3.

[11] *Journ. Anthrop. Inst., London*, XIII., p. 346.

[12] *Journ. Roy. Soc. N. S. Wales*, XXXII., pp. 82–3.

[13] *Journ. Anthrop. Inst., London*, XIII., p. 302.

I have thought it right to draw attention to the differences between Dr. Howitt's statements and mine in order that the anthropologists of America and Europe may have both our views before them to assist them in arriving at a conclusion regarding the line of descent in the cases under notice, because it is a matter of the highest importance.

R. H. Mathews

UNIFORMITY IN ENGLISH ABBREVIATIONS

To the Editor of Science: Is not the time ripe for uniformity in English abbreviations?

Perhaps the best way of bringing about such uniformity is through the issue, by some authoritative body, of a code in which, so far as possible, the roots of the words would be retained, a code somewhat similar to that used by the employees of the Associated Press. From such a code writers could probably be induced to take all their abbreviations which are to appear in print.

Such a code, if supported by strong authority, would probably be used by many writers for the press; and if learned through a course of years would not likely be a great strain on the memory, even though somewhat elaborate.

The present time seems to be propitious because workers in many special fields are introducing abbreviations of their own devising, many of them calling for the consultation of a table. From the point of view of the general diffusion of technical knowledge, it will prove unfortunate if the trials of the lay reader are increased by abbreviation of technical terms and the most direct road to preventing this is to decrease the labor of the scientist by abbreviating common terms.

The undersigned would be glad to hear from any parties who are interested in such a plan.

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INDISCRIMINATE KILLING OF MUSK OXEN

To the Editor of Science: A number of facts are coming to light at the present time which must, in the minds of all thoughtful

people, throw a grim and sinister side light on Arctic exploration as carried on by Americans. In the *Yale Alumni Weekly* of October 8, p. 56, for instance, is a highly interesting human document from the pen of Mr. George Borup, a young man who accompanied Lieutenant Peary on his recent expedition. He recites some of his experiences as follows:

> . . . Here [at Cape Morris Jesup, past Lockwood's furthest of 83° 24′] we stayed two weeks. . . . Here we lived high, killing 47 musk oxen in four hunts, and dogs and men had sirloin and tenderloin all the time. As none of us had had any fresh meat in three months it was more than good. I got mixed up in one herd of sixteen and took some good photos of them. Then we killed them all by gun. I beat all records, Duffy's included, when I got within ten feet of a big bull, held at bay by two dogs, to take his photo, and he charged the dogs, which happened to be on a line between us. I only hit the high spots for a hundred yards or so. Coming back . . . went off on a hunting trip. Killed four musk oxen, 100 miles away, and brought back a calf on the sledge alive to the boat, only to have it die the next day. When we got down to Eskimo land we put in about four days walrus hunting. In all about 72 were secured.

It thus appears that the indiscriminate killing of the musk oxen has been the common diversion of Americans in the north. Other explorers have been more thoughtful, notably the Swedes, who made an unsuccessful attempt to domesticate these splendid animals in Lapland. It is well enough known that the musk oxen once spread southward to the Hudson Bay country, and westward to the Mackenzie River, and that they are now on the verge of extinction, but a few hundred being perchance all that are left. In short, Mr. Borup does not appear to have been aware of the deadly results following in the train of his hunting.

But it is difficult to understand such a recital, such an exhibition of the "*mord lust*" by any human being, leaving out of account the unwitting confession that this slaughter took place just about the calving time, or a little before in the case of the larger herds, it might seem. And did this finally compassionate hunter expect to suckle the last musk ox he saw, the little calf he took back to the boat, "only to have it die"!

In the main, however, we hold Lieutenant Peary directly responsible. He should have issued orders to protect these animals, and if our Arctic exploration had been carried on on a higher and more scientific plane this would have been done. Nor do I hesitate to say that in my judgment it was of more importance to avoid the slaughter of these musk oxen and walrus than it has proven to march across the ice, only to bring back the records of a scanty performance. The man who is broad minded and thoughtful and merciful, and careful of his temper, and who describes with the needed care a single new beetle or brachiopod, deserves better than these notoriety-seeking types of scientists. Indeed it is time that the halo they wear should be more carefully examined. For my part, I have never seen the day when I did not find it easier to work in the field than in the laboratory, and I believe it is so with most scientific workers.

There is, with the great increase in comfort within recent years, relatively no more risk in the glorious holiday that an Arctic exploration can with ordinary forethought be made to mean, than there is in more serious scientific work indoors.

In view of such pertinent facts it is greatly to be hoped that future Arctic exploration will be carried on in a more humane and scientific spirit.

G. R. WIELAND

SCIENTIFIC BOOKS

The Science and Philosophy of the Organism. The Gifford Lectures before the University of Aberdeen. By HANS DRIESCH, Ph.D., Heidelberg. Vol. I., 1907, pp. xiii + 329; Vol. II., 1908, pp. xvi + 381. London, A. and C. Black.

Das Kausalitätsproblem der Biologie. Von Dr. med. FRIEDRICH STRECKER, Privatdozent an der Universität Breslau. Pp. viii + 153. Leipzig, Engelmann. 1907.

Driesch's Gifford Lectures give the English reader his first introduction to an interesting and important movement in recent German thought—the *rapprochement* between biology and philosophy that has been taking place

during the past fifteen years. The movement is significant chiefly because of the side from which most of the approaching has proceeded. It is a case of biologists turning to philosophy because of problems arising in their own inquiries, not the more usual case of philosophers utilizing or criticizing the results of biology. To the student of philosophy the discussions thus arising have something refreshing about them because they bring philosophical issues into apparent connection with concrete and contingent matters of fact; whereas the idealistic or the "double entry" systems of the *Kathederphilosophen* have, for the most part, long since been divorced from any such relation to specific items of reality, and have represented philosophic truth as a fixed, all-inclusive, ornamental frame for the universe, into which any particular that chances empirically to turn up will fit as harmoniously as any other. The disputations of the newer biological philosophies may often be philosophically naïve, but they lend to metaphysics an unwonted and pleasing appearance of life and pertinency, through their constant movement back and forth between philosophic principle and empirical fact. The occasion for this awakening of interest in ulterior problems on the part of biologists has been the appearance, among their own ranks, of a large and aggressive school of vitalists. In the case of those who, perhaps, best deserve to be called "neo-vitalists"—Driesch and G. Wolff—this tendency has been an unexpected and somewhat paradoxical outcome of the impulsion given by Roux to experimental research in morphology and physiology, to the science of *Entwicklungsmechanik;* "all the new facts," says Driesch, "in support of the doctrine have been found in this field of inquiry." But vitalism has found vigorous spokesmen among specialists of high standing in nearly all branches of biological science: Bunge representing physiological chemistry, Hertwig representing morphology and embryology, Pauly representing phyletic zoology, Reinke representing botany, and, in France, Bergson representing psychology. Besides these leaders, a considerable army of writers less well known have produced an imposing array of vitalistic books and pamphlets; and one of the wings into which the school is divided has since 1907 had a special periodical organ for the diffusion of its opinions, Francé's "Zeitschrift für den Ausbau der Entwicklungslehre." So great and so rapid has been the progress of the movement that the philosophic thinker who has most influenced it, E. von Hartmann, declared confidently before his death (in his "Das Problem des Lebens," 1906) that we are justified "in looking forward to a complete triumph of vitalism in the course of the twentieth century."

However that may turn out, the doctrine has thus far shown itself to be a sort of biological protestantism. Its adherents are united in their negations—they are at one in declaring that vital phenomena can not be described or "explained" in "merely mechanistic terms." But when it becomes a question of new theoretical construction, they split into warring sects. The ground of quarrel concerns the nature of the non-mechanical factor or factors to be recognized by biology, after the inadequacy of mechanistic causation has been admitted. The two principal views held upon this point may be called respectively psychological vitalism (or biological animism) and non-psychological vitalism; the latter, unsympathetic interpreters have sometimes been tempted into calling mythological vitalism. The psychological vitalists are those who find in the phenomena of consciousness—and especially in the immediately felt inner nature of simple awareness and desire and aversion—some clue to the sort of causal process which must be assumed to account for the peculiar unity, the definiteness of form, and the adaptiveness, of living things and their functioning. If science finds mere mechanism at one end of the scale of being—and, as is generally assumed, at one end of the evolutionary series—it just as surely, or more surely, finds sensation, feeling, memory and volition at the other end. And to the psychological vitalists it seems nothing less than an axiom of scientific method that our "immediate" knowledge of psychic causation should be used to inter-

pret the causal processes at work in those living beings below us in the scale of complexity and behind us in the evolutionary order. Bunge says:

The essence of vitalism consists in this, that we follow the one correct road to knowledge, that which starts from the known of the inner world in order to arrive at the unknown of the outer world. Mechanistic theories follow the opposite and misleading course—they set out from the unknown in order to arrive at the known. Johannes Müller in his doctoral dissertation defended the thesis *psychologus nemo nisi physiologus*. The time will come when the contrary thesis, *physiologus nemo nisi psychologus*, will need no defender.

Of this type of vitalism Strecker's book is representative; it urges the necessity of reversing the customary logical procedure of biology, of "beginning with man, in whom the causation of development is now going on, and reading *rückwarts nach dem Primitiven* that which we find in man, namely, the processes of inner life." Similar views have been elaborated by Pauly, in his "Darwinismus und Lamarckismus." The oddest outcome of this tendency is the production by Francé of a system of "plant-psychology," expressed most fully in his "Das Leben der Pflanze," 1905, 1907, and in papers in his magazine. Though this certainly has a queer sound, it is not quite so grotesque as may be supposed. The doctrine of Pauly and Francé, at least, is merely a kind of Lamarckism, with the potential animistic elements in the Lamarckian conception of "needs" very much emphasized.

Over against these stand such vitalists as Driesch, Reinke, K. C. Schneider, who find the doctrines just mentioned reprehensibly anthropomorphic. But in their flight from the hobgoblin of anthropomorphism, some of these theorists fall into the arms of what—to the average biologist unaccustomed to them—will seem monsters of still more frightful mien. Driesch, for instance, having, as he believes, proven that such phenomena as morphogenesis, restitution and purposive behavior, have a teleological character not to be explained by the operation of any of the forces or entities ordinarily recognized by science, feels obliged to assume the existence of certain non-physical, but also non-conscious, agents for these effects. By culling diligently in scattered places in Driesch's second volume, one may gather the following list of the attributes of these agents, generally called "entelechies" (or, collectively, "entelechy"): (1) They are not in space; (2) they are not quantitative; (3) they are, therefore, not forms of energy; (4) they have "in no case anything of a psychical nature," though metaphorically or "by analogy" they may be said to know and will—a figurative mode of speech to which, it should be noted, their discoverer is himself much addicted; (5) they seem to be capable of self-multiplication—for "the primordial entelechy of the egg creates derived entelechies"; (6) their function is not to cause in the organism chemical reactions which otherwise would not occur, but only "to suspend for as long a time as (they) want any one or all of the reactions which are possible with such compounds as are present, and which would happen" if the entelechy did not intervene; (7) this function they probably perform, not by acting directly upon ordinary processes of chemical union, but by "activating" certain catalytic agents, which are the physically perceptible instruments of their teleological control. Such are entelechies in general; they are divided into two principal classes with distinctive habits; namely, morphogenetic agents and behavior-directing agents, the latter specifically known as "psychoids." Even these last are not conscious; they only accompany consciousness. For Driesch has a curious psycho-psychoidal parallelism of his own, quite distinct from the usual psycho-physical parallelism. It is not clear just how Driesch's entelechies differ from Reinke's "dominants," except that the dominants seem to be more numerous. Both form hierarchies somewhat like that of the German army. Neither sort of agent either creates or nullifies energy; both Reinke and Driesch are very solicitous to avoid conflict with the first principle of energetics, though they show less deference to other physical principles that appear empirically to be equally well grounded.

The teleological factors merely give direction and correlation and *tempo* to transfers of energy.

All this midsummer-night's dream land of biology, peopled with strange, elflike creatures, is, assuredly, the negligible part of contemporary vitalism. It is not in these premature and over-ingenious efforts of the constructive imagination that the new tendency has anything of present value to contribute to science or philosophy. But in the common and fundamental negative creed of all vitalists—their denial of the possibility of "reducing" all laws of organic action to consequences of the laws of mechanical action—there lies a significant and debatable issue. Yet even this fundamental issue is often ill formulated. One result of the whole discussion thus far has been to involve in a good deal of obscurity and confusion the meaning of the primary notions concerned—the notions of mechanism and vitalism. It has become difficult, in the absence of clear and generally accepted definitions, to make sure who should be called vitalists and who should not. Thus the writer of a recent historical sketch (Bräunig) classifies Nägeli, Eimer and Haacke as vitalists in spite of themselves. Driesch insists that Strecker is a real, though misguided, vitalist, while Strecker prefers to regard his doctrine as a "third standpoint," essentially different from both vitalism and mechanism. Certain of the school of *Energetiker* who recognize a specific vital form of energy call themselves vitalists, others appear to regard themselves as champions of mechanism; Driesch regards the latter classification as correct, because even "vital energy" is a quantitative conception. Le Dantec affirms, while Driesch denies, the chemical distinctiveness of living matter; but Le Dantec passes for an extreme opponent of vitalism. Through their diverse affiliations with current theories on cognate problems, the two parties exhibit almost all possible varieties of doctrinal hybrids. Le Dantec appears to be a mechanistic neo-Lamarckian; Pauly, a vitalistic neo-Lamarckian; Wolff, a vitalistic anti-Lamarckian. The result of all this confusion has been a great deal of arguing at cross-purposes, of which both sides have been guilty. I cite only one illustration. Zur Strassen, in a "refutation" of Driesch[1] contends that before any such phenomenon as restitution can serve as a pertinent argument for vitalism, each instance of it must be shown "to have no utility for the organism in which it occurs, and therefore to be a power that can not have been produced through natural selection." For causation through selection is mechanical causation. In so arguing, Zur Strassen is jumbling together two distinct senses of "mechanical." We speak, indeed, of the Darwinian explanation of the adaptive characters of organisms as a mechanistic explanation. But we mean thereby only that it is not teleological, that it represents the given effects as resulting from the pressure of external circumstances, through accidental conformity to which certain variations get selected. We do *not* mean that Darwinism traces the laws of species-forming back to the laws of molecular mechanics. Yet it is only in the latter sense that "mechanism" need be antithetic to vitalism. Darwinism takes the incipient useful variation for granted. But the argument of the vitalist is, or may be, drawn solely from the nature of the variation, not from the fact of its selection and survival as a character of a species. Its survival may be due to its usefulness; but it may itself, from the outset, constitute a mode of behavior of matter which is not reducible to mechanical law nor explicable as the result solely of the spatial ordering of material particles. It is for this latter conclusion that Driesch contends. Zur Strassen's objection to the argument from restitutions is, therefore, quite beside the mark.

Since little that is profitable can be said upon the subject until these confusions are cleared up, it is worth while to attempt to distinguish the possible meanings of the denial that vital phenomena can be "mechanistically" explained. The denial may refer primarily to the way in which the matter in the organism behaves, while, in a given living individual, a given physiological process is

[1] Roux's *Archiv*, 1908, p. 158.

going on; or it may refer to the antecedent processes by which organisms came to have that adaptation of form and function to the requirements of their external environment, which has somehow been brought about in the course of evolution. Taken (A) with the former reference, the vitalist's negation might mean any one of three propositions. (1) It might mean merely that vital phenomena are irreducibly unique, in such wise that the laws of their occurrence could never be deduced from even a complete knowledge of the laws of the behavior of matter under all *other* conditions than those under which these phenomena occur. In this sense, vitalism would be a species of "logical pluralism," of the general doctrine of "the heterogeneity and discontinuity of phenomena," which M. J. H. Boex-Borel has just set forth at length in his "Le Pluralisme." Such a doctrine would not be incompatible with a "chemical interpretation" of vital phenomena, so long as they were regarded as the unique modes of action of a unique chemical compound under certain physical conditions—modes of action which no acquaintance with the components separately, nor with other compounds, would have enabled one to predict. In this meaning, which seems to me the most convenient general meaning for the term, many biologists not commonly so called might be classified as vitalists. (2) The vitalistic negation may go farther, and declare that certain peculiarities of the behavior of matter in organisms can not be regarded as functions of even a unique chemical compound with unique modes of action. This might be proved if it could be shown that the peculiarities in question and chemical composition are independent variables. Driesch contends that such proof is possible, through an examination of the facts of morphology. "Specificity of form as such does not go hand in hand with specificity of chemical composition." (3) Chemistry itself, however, is by no means a truly mechanistic science; for it has never succeeded in interpreting all its qualitatively diverse phenomena as mere quantitative multiples of the separate properties or modes of action of the individual atoms entering into chemical relations. Vitalism may, however, passing by the question whether vital specificities and chemical specificities are correlative, attack the notion of mechanism as such; it may, namely, deny that the properties or activities of an organism can be functions of the presence, in a specific spatial grouping, of a determinate number of physically interacting units of matter or energy. It is to the defense of this view that Driesch chiefly devotes himself. He finds his arguments for it in such facts as the totipotency of isolated blastomeres, and the development of excised portions of the branchial apparatus of *Clavellina* into small but complete organisms. These facts show that in certain cases part of an organism can do the work of the whole—*i. e.*, produce the typical form ordinarily produced by the interaction of that part with all the other parts. Here, unquestionably, is a perfect refutation of mechanism *in the sense just defined;* the facts mentioned constitute a virtually tautological proof that, in these cases, morphogenetic processes are not functions of the *absolute number* of material units present, nor of any single scheme of relative spatial positions of a determinate number of units. Not the single cell, but the whole organism, is the morphological individual; for when the normal number of other cells are present in interaction with a given cell, the cell behaves in one manner; when the other cells are removed or transposed it behaves in another manner; but the resultant morphogenesis of the entire organism remains the same, in spite of these diversities of behavior of the single cells composing that organism. In bringing this out so plainly as he has done, Driesch has made a contribution of the first importance to our knowledge of the distinguishing peculiarities of living material systems. But it does not follow (as he supposes) from these facts that the specific morphogenetic action of, say, an *Echinus* egg, may not be a function of *some* (as yet undetermined) specificity of composition or structure or physical relations of the original material complex constituting the egg at the moment of fertilization. In other words, Driesch's arguments from morphogen-

esis and from restitutions do not appear to compel us to go beyond vitalism in sense (1) —a sense which he would evidently regard as tantamount to mechanism.

The vitalistic negation may, however, (B) refer to the large processes of phyletic evolution, or to the adaptations which have been realized in the course of that evolution, rather than to the peculiarities of the behavior of the material elements in individual living bodies. Some vitalists (Bergson and Pauly, for example) make much of considerations of this type. But this is only a superficially distinct form of the negative side of vitalism. For all these large aspects or consequences of evolution must be due primarily to processes of form-building taking place in the development of individual organisms. The vitalist must, then, in any case, maintain that these separate processes in the individual are not capable of "mechanistic" explanation; and his doctrine will, therefore, in the last analysis reduce to one of the three negations mentioned in the preceding paragraph. It remains possible that important evidence for one or another of these contentions may be found by the examination of the lines of direction and the broad results of racial evolution—of such phenomena, for example, as orthogenesis.

This review seemed most likely to be useful if it were made a species of historical and systematic introduction to the vitalistic controversy. In the discharge of the usual duties of a reviewer, however, it should be added that Driesch's book, though an important and valuable contribution to the discussion over vitalism, is not very successful as a work of popularization. It is ill planned and awkwardly executed, diffuse, involved, and written in a tongue far removed from idiomatic English. If designed to appeal to biologists and philosophers, on the other hand, the book would have been more effective if the author could have brought himself to let the entelechies alone, to omit many of his excursions into Kantian epistemology, and to content himself with expounding and interpreting (as he is eminently qualified to do) all those distinctive peculiarities and "discontinuities" in the action of living matter, which have been definitely established by the past twenty years' progress in the study of *Entwicklungsmechanik.*

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A Treatise on Zoology. By Sir Ray Lankester. *Crustacea,* W. T. Calman. Part VII. Appendiculata. Third fascicle. London, Adam & Charles Black. 1909. Price, twelve shillings and sixpence, net.

This is an excellent account of the class of the Crustacea from a purely zoological standpoint. The most important and striking feature of the book is the systematic arrangement of this highly diversified group of creatures, and the zoologist who is acquainted with the older systems of the crustaceans will be astonished, at the first glance, that certain systematic groups, which are familiar, have entirely disappeared. So, for instance, there are no "Entomostraca," no "Edriophthalma" and "Podophthalma," no "Schizopoda." Yet the new system used by Calman is entirely founded upon the most recent investigations, to which he himself has contributed a good deal.

In the present book, the class of Crustacea is divided into five subclasses: Branchiopoda, Ostracoda, Copepoda, Cirripedia, Malacostraca. The latter subclass consists of two "series": Leptostraca (order: Nebaliacea) and Eumalacostraca, with four "divisions": Syncarida, Peracarida, Eucarida and Hoplocarida. The Syncarida consist of the order Anaspidacea (the remarkable, recently discovered genera *Anaspides, Paranaspides, Koonunga* and possibly *Bathynella,* the affinities of which have been worked out chiefly by Calman himself); the Peracarida contain the orders Mysidacea, Cumacea, Tanaidacea, Isopoda, Amphipoda; the Eucarida possess the orders Euphausiacea and Decapoda, and the Hoplocarida the order Stomatopoda. This arrangement surely represents the natural affinities better than any of the older systems. Of course, it is impossible, in a review, to give a full account of the morphological facts, which substantiate the views of the author, but these facts are prop-

erly set forth in the text by him under the different groups, by frequent comparison of their structures with those of the other groups.

In the first chapter, a general account of the whole class is given, including a *historical sketch*, the general *morphology*, the *embryology*, *phylogeny* (chiefly with regard to the fossil forms). The morphology treats of the morphological and anatomical details in the following sequence: exoskeleton (body, limbs, branchiæ), alimentary system, circulatory system, excretory system, nervous system and sense organs, glands, phosphorescent organs, reproductive system.

Of the following chapters, II. to V. treat of the Branchiopoda, Ostracoda, Copepoda and Cirripedia, and the same general arrangement of the subject matter as above is followed under each group. Chapter VI. gives a general morphological introduction to the subclass Malacostraca, defining their systematical divisions, and of the following chapters, VII. to XVI., each gives an account of one of the orders of the Malacostraca: Nebaliacea, Anaspidacea, Mysidacea, Cumacea, Tanaidacea, Isopoda, Amphipoda, Euphausiacea, Decapoda and Stomatopoda.

In the treatment of the various groups, the general arrangement is similar to that used in the introductions to the larger groups, but "remarks on habits," a more detailed discussion of "paleontology," and remarks on "affinities and classification" are added, and this is followed by a sketch of the system, which gives diagnoses of the main systematical divisions of each order, bringing it down to the families and genera, the former of which are quoted rather completely by name, while of the latter the most important ones are named.

The different orders have received a rather uniform treatment, which is a feature of the book which should be especially mentioned, for we may sometimes observe, in similar treatises, that the author is not quite impartial, devoting, for obvious reasons, more time and space to those groups to the study of which he has applied himself more energetically. Calman has avoided this, and thus the whole book makes the impression of a carefully planned and well-executed attempt to give an account of the morphology, anatomy and embryology of the whole class. At the same time, nothing of importance has been omitted. Of course the remarks on habits and on paleontology are rather short, and might be regarded as unsatisfactory, but we are to consider that the book forms a part of a series entitled, "A Treatise on Zoology," and not of ecology or paleontology, and thus these sides could not have been considered to any extent in a book of this character. For the same reason also remarks on geographical distribution are omitted.

The book preeminently is a zoological treatise, dealing with the purely zoological side of the matter: morphology, anatomy, embryology and the systematics. With regard to this, it is a complete success, and should be used, by zoologists, not only by the side of other textbooks, but is apt to supersede the latter, thus becoming, for the present time, the standard text-book on crustaceans. Anybody desiring to get any information within the range as defined above will surely find it here, and not only this, but he will find the account given up to date. A rather complete index will serve to facilitate the search for the desired information, and references to literature at the end of the various chapters will give a direction for the study of further particulars.

A. E. ORTMANN

Lehrbuch der Paläozoologie. Von E. STROMER VON REICHENBACH. I. Theil: Wirbellose Tiere. Pp. 342; 398 text figures. Leipzig, Teubner. 1909. Price 10 Marks in cloth.

Von Stromer presents here an excellent elementary text-book of paleontology, written in good style and not too technical in language. It deals with the fossil invertebrates viewed almost entirely from the biologic standpoint, and while the geologic development is also presented, it is too much abbreviated to be of much value from the side of evolution or stratigraphy. The illustrations are excellent half-tones of wash-drawings made especially for the work. The printing, of course, is the best and the weight of the book not heavy.

All of the classes of invertebrates found fossil are described in more or less detail according to the prominence of the classes. These are taken up first in a general way to acquaint the student with the hard parts and the relation of the soft parts to them. The orders and suborders adopted are up to date and these are next concisely described, but no further classification is offered, nor are the genera, even the common genera, defined. The various groups are illustrated by a few well-selected forms and these are carefully described in the legend as to the source whence obtained, the name of the animal, locality and formation, order or family and the symbols referring to the detailed structures.

Most of the classes are adequately treated for an elementary work, but a few are handled too briefly to give a proper conception of their intricacy. For instance, the crinoids are described in nine pages and the horde of Camerata in one, the Hydrophorida or Cystidea proper in four, the starfishes and ophiurids each in three, and the varied and very important Paleozoic trilobites in six. American paleontologists will be also disappointed to see the Trepostomata Bryozoa still ranged among the tabulate corals.

Charles Schuchert

Yale University

Light. By Richard C. Maclaurin, President of the Massachusetts Institute of Technology. New York, published by the Columbia University Press. 1909.

A popular exposition of selected topics, being the Jesup lectures delivered at the American Museum of Natural History during the winter of 1908–9. This book, while not comprehensive enough to serve as a text-book, will meet the requirements of those who wish to acquaint themselves with the experimental part of the work that has given us our modern theory of light. The subjects are treated in the following order: (1) Early Contributions to Optical Theory, (2) Color Vision and Color Photography, (3) Dispersion and Absorption, (4) Spectroscopy, (5) Polarization, (6) The Laws of Reflection and Refraction, (7) The Principle of Interference, (8) Crystals, (9) Diffraction, (10) Light and Electricity. The author's standing as a physicist is a sufficient guarantee that the book is free from errors, and the subject is treated in a very readable manner, free from mathematics and requiring little or no previous knowledge of the subject on the part of the reader. It brings the subject down to date, or as much so as can be expected in a popular treatment.

R. W. Wood

RECENT VIEWS OF L. CUENOT ON THE ORIGIN OF SPECIES BY MUTATION[1]

The results obtained in the study of variation from the point of view of its origin, of its morphological significance and of the integral transmission of mutations as opposed to fluctuations, could not but exert a profound influence on the hypotheses that have been brought forward to explain evolution. It is of particular interest to compare these results with the classic theories of Lamarck and Darwin. Primarily, these are attempts to account for the phenomena of adaptation: Lamarck invokes use and disuse, effort and habit, and considers their effects as directly adaptive and hereditary; thus he explains the evolution of organs necessary for life in certain surroundings and the regression of those that are useless under an animal's particular environmental conditions.

Darwin, while admitting the effects of use and disuse, emphasizes above all the selection of minute fluctuating variations, favorable in the struggle for existence, and thus he explains morphological changes and the final perfection of adaptation in an organ as the result of a slow and continuous progress.

To be sure, the sudden appearance of certain mutations, transmissible in their entirety, and the instability of fluctuating variations, are factors not at all in accord with Lamarck's attempted explanation, nor with that of Darwin; but perhaps there are no longer many

[1] Cuénot, L., 1908, "Les Idées Nouvelles sur l'Origine des Espèces par Mutation." Translated from *Rev. gén. Sci. pures et appliq.*, Ann. 19, no. 21, 15 nov., 1908.

rigorously orthodox Lamarckians or Darwinians among biologists. Little by little, just as modern houses are built with the ruins of ancient temples, an edifice has risen out of the crumbling theories of Lamarck and Cope, of Darwin and Wallace, of Eimer and Weismann —an interpretation of evolution which retains the tested facts of all previous attempts at a general explanation and which, with no pretense of finality, keeps the unbridged gaps well in view. Seven years ago, I wrote for the *Revue* an article[2] in which this theory was anonymously set forth and I find it needs very little modification at the present time. According to this theory, the unforeseen modifications of the germ plasm—whether called mutations or sudden or discontinuous variations—produced at a last analysis by environmental changes, are the source of the morphological and physiological differences that distinguish one definite species from another. This, as will be readily seen, is neither Lamarckism nor Darwinism. Natural selection controls development in animals and in plants by the elimination of the individuals and species not adapted to survive under given conditions, a selection which permits only the "fit" to exist. The adaptations indispensable for life in given surroundings must therefore precede chronologically these environmental conditions and they are not determined by the conditions to which they seem to correspond with such nicety. Herein lies the most original point of the theory and one that will, no doubt, meet with the greatest opposition. I prefer not to dwell upon it here but shall defer its demonstration to a later time.

THE FILLING OF UNOCCUPIED PLACES IN NATURE AND THE ORIGIN OF ADAPTATIONS[3]

IN the theory of the *survival of adaptive mutations*, as set forth above, neither Lamarckian factors nor the selection of minute variations determines the appearance of new characters. The mutations occur fortuitously as continuous or discontinuous, the result of modifications in the germ plasm. If by chance the variant, such as it is or by some change of function, is adapted to fill a void in nature and is able to reach this unoccupied place, it has the opportunity to survive and to found a new stock; if not, it remains in its original surroundings or disappears. Formerly, when unoccupied places were more abundant, in fresh water, in marshes, in cracks and caverns and on the earth's surface, in the air, in the polar regions, conditions were favorable to the differentiation of new species and new groups; now mutations have an ever-decreasing chance of finding an occupied place in the fine balance of life already established, and evolution, if not entirely checked, has at least become much retarded.

[2] L. Cuénot, "L'évolution des théories transformistes," *Revue générale des Sciences*, t. XII., p. 264, 30 mars, 1901.

[3] Cuénot, L., 1909, "Le Peuplement des Places Vides dans la Nature et l'Origine des Adaptations." Translated from *Rev. gén. Sci. pures et appliq.*, Ann. 20, no. 1, 15 janvier, 1909.

SPECIAL ARTICLES

THE QUESTION OF VIVIPARITY IN FUNDULUS MAJALIS

IN a paper dealing with the process of heredity in *Fundulus* hybrids[1] certain well-marked differences were shown by the writer to exist between the two reciprocal crosses. While a large per cent. of the hybrids, obtained by fertilizing the eggs of *Fundulus heteroclitus* with the sperm of *F. majalis*, hatched and, in some cases, throve for months after hatching, the embryos of the reciprocal cross (*F. majalis* eggs fertilized with *F. heteroclitus* sperm) developed well for about two weeks and then ceased to grow. These embryos developed from the larger eggs of the larger species, yet reached a maximum size only equal, on the average, to that of the just hatched young fish of the smaller species, *F. heteroclitus*. Although morphologically sufficiently advanced, they never hatch, but remain stranded on a large yolk mass which they seem incapable of assimilating.

These and other peculiarities of cross-bred

[1] "The Process of Heredity as Exhibited in the Development of Fundulus Hybrids," *Journal of Experimental Zoology*, Vol. V., No. 4.

F. majalis embryos were dealt with by the writer as physiological conditions resulting from an incompatibility of the germinal materials involved, and furnished the basis for the discussion of a number of general questions. It was, then, somewhat of a shock to learn through the kindness of Dr. H. D. Senior, of the Syracuse University Medical School, that the well-known ichthyologist, John A. Ryder, had in 1885 described *Fundulus majalis* as a viviparous species. If Ryder's statement were correct it would be necessary completely to revise all statements made by the present writer that were based on the assumption that the species in question is strictly oviparous. The failure to hatch, for example, might be due to abnormal environment.

In the paper referred to[2] Ryder, after dealing with certain well-authenticated cases of viviparity among the Pœcilliidæ, describes in a final paragraph (p. 155), under the heading "The Viviparity of *Fundulus*," another type of viviparous embryo, differing from *Gambusia* in having a distinct *zona*. The vitelline circulation is described and several points of similarity between *Fundulus* and *Gambusia* are noted.

On Plate XI., figs. 29 and 30, are pictured two rather advanced embryos of *Fundulus majalis*, described in the legend as having been "forced from the ovary by pressing the abdomen of the living fish." These figures bear a general resemblance to the corresponding stages of the *F. majalis* embryos studied by the writer, but might readily represent those of some other species. The thick gelatinous envelope characteristic of the extruded eggs of *F. majalis* is omitted in the figures.

During the past summer the opportunity was offered for thoroughly testing the question of viviparity in this species, and the results of the test force the conviction that *Fundulus majalis*, as it occurs at Woods Hole, Mass., is strictly oviparous and that the conclusions expressed by the writer in the paper on *Fundulus* hybrids are founded on no misconception regarding the normal mode of gestation of the *F. majalis* embryos.

The following are the considerations that have forced this conviction:

1. Literally thousands of females of this species have been stripped by the writer and by many other students and investigators during the past decade, and no one has ever reported the extrusion of an egg containing an embryo.

2. This summer many females were opened at all stages of the breeding season. In no case were embryos found.

3. The number of eggs extruded at one time by a single female may run from 200 to 800. This number is far in excess of that which could possibly develop within the mother. It is well known, moreover, that viviparous species, whether with ovarian or oral gestation, have small numbers of eggs, usually not over 25 to 50.

4. The eggs are provided with a thick, somewhat fibrous, gelatinous coat, that causes them to adhere, after extrusion, to objects on the bottom. The function of such an envelope could scarcely be conjectured on the assumption that the species is viviparous.

5. A study of the spawning behavior of *F. majalis* has shown that, at least in captivity, the eggs are extruded during the spawning act and are fertilized externally by one or by several males.

6. The anal fin, which, in truly viviparous species like *Gambusia*, is modified into a stiff, pointed intromittent organ, is, in *F. majalis*, soft, blunt and in no way adapted for intromission.

7. Several masses of normally developing *F. majalis* eggs were found in the sand at low tide, closely associated with the eggs of *Limulus*. These eggs were identified as belonging to the species mentioned by several investigators at the Woods Hole laboratories.

There appears, then, to be a marked discrepancy between Ryder's statement and the facts here detailed. No satisfactory explanation of so wide a divergence of statement offers itself at the present time. It might be suggested,

[2] "On the Development of Osseous Fishes," *Proceedings of the United States National Museum*, Vol. VIII., No. 9.

however, that there is a possibility that the variety found off the Virginia coast, where Ryder made his observations, may show viviparity; but this is hardly likely to be the case.

Two possible explanations suggest themselves. Either Ryder dealt with another species, which he considered to be *F. majalis*, or he mistook for ovarian embryos some of the latter that had been eaten by the female under observation and had passed through the alimentary canal undigested. These fish have been observed to eat large numbers of their own eggs. The latter may pass through the alimentary canal without suffering the loss of anything but the gelatinous envelope. The embryos, however, that have passed through this experience are always dead. It seems scarcely likely that so excellent an observer as Ryder should have been led into a mistake of this sort; yet this appears to be the most likely explanation of the discrepancy.

H. H. Newman

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DEVICES FOR CHANGING THE TIMBRE OF MUSICAL INSTRUMENTS

Enclosed is a rough sketch of a curious bridge, used on a Hindu stringed instrument, whose strings are picked. Fig. 1 shows top of bridge, and Fig. 2 an end view. There is a slight ridge near the lower side. Five grooves

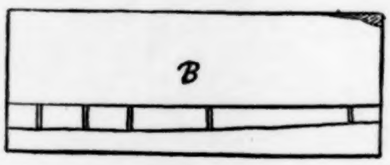

Fig. 1

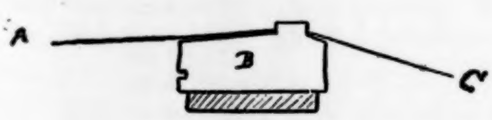

Fig. 2

are cut on this ridge for as many wire strings, whose relative position with the bridge is shown in Fig. 2. *A* represents the vibrating part of the string; *C* the part attached to the tail piece. The vibrations of the string against the bridge produce a burring sound, which seems to be favored by the orientals.

In the "ti-tzu," a Chinese transverse flute, there is a hole, about the same size as the mouth-hole, half-way between the latter and the upper finger-hole, which is covered with a thin tissue, making a sympathetic drum, which changes the reedy timbre of the flute.

In a bamboo horn of the Filipinos, the lower end of the bamboo is split into strips about three eighths of an inch wide, producing a similar sound or result.

In Africa, the negro xylophones, marimbas, those that have a gourd resonator suspended beneath each sounding bar, have some of the gourds perforated and covered with a thin piece of cocoon, thus forming a sympathetic drum, and likewise changing the timbre of the instrument.

Would not such instruments have anything but a soothing effect on the nerves of our musicians? But it was not always so. According to Mersenne, the beginning of the seventeenth century saw bands of four or five all playing on onion flutes, which met with great favor all through western Europe. This flute consisted of a straight wooden conical tube, with conical bore, the mouth hole on the side, and the open, small end of the tube covered with a thin skin of an onion; hence the name. The player sung or hummed the tune into the instrument, which resembled our modern kazoo or zobo, the change of timbre due to onion skin being pleasing at that period.

I have just come across the following article by A. C. Moule in the North China branch of the Royal Asiatic Society, 1908, page 78:

> Rev. F. W. Galpin, of England, informs me that the device of covering a hole with membrane was not characteristic of the English recorder, as is sometimes stated; but that in the early part of the eighteenth century a transverse flute, called the *voice flute*, was produced in London with a membrane exactly like that of the Ti (the ti-tzu).

An advertisement of "a rare concert of four trumpets marine, never before heard in England," appeared in the London *Gazette*, of February 4, 1674. Some authors claim that

this was the first bowed instrument in Europe. It had a peculiar bridge, one foot of which was much longer than the other, as the former had to pass through a hole in the belly and rest on the back (inside) of the instrument; the shorter foot rested on the belly. The one string which it boasted rested on the bridge directly over the long foot. The result was that the vibrations of the string caused the short foot of the bridge to beat the belly. Often, to prevent wear, that portion of the belly receiving the beating was inlaid with a plate of bone or metal. The marine trumpet was quite common in Germany, being called marien Trompet, also Nonnengeige, the latter because nuns used it in the trumpet parts of their devotions.

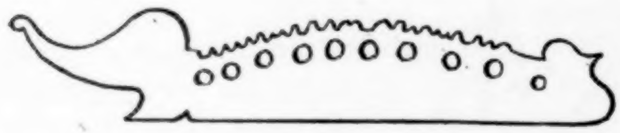

FIG. 3

Fig. 3 represents a nut found on several Hindu stringed instruments, on exhibition in this museum. I believe that they are used in connection with their musical scale, in which the lowest note is that of the elephant, and the highest that of the peacock.

I should like to know if any one has expressed a theory about either the bridge or nut.

E. H. HAWLEY,
SMITHSONIAN INSTITUTION

THE PICKENS COUNTY METEORITE

THE stone-iron meteorite here described was sent to the office of the state geologist about eighteen months ago from Pickens County, Ga., together with a number of minerals and rock specimens, for identification. A rather extensive inquiry through correspondence and even a personal visit to Pickens County has, so far, given no definite information as to the exact locality from which the meteorite was obtained.

When first seen, the specimen, which weighed fourteen ounces, was roughly cubical in shape and had the appearance of being a part of a larger piece. Five of the faces of the irregular cube showed comparatively fresh surfaces, while the sixth side was more or less oxidized and showed a somewhat pitted condition, as if it was an original surface. In color and texture it closely resembles basalt, the dark color being blotched here and there by brownish-red spots, which seem to be due to the oxidation of the contained particles of metallic iron. With the exception of the metallic iron, which occurs in irregular masses a fourth of an inch or less in diameter, and which makes up something like ten per cent. of the entire mass, none of the other minerals can be made out without the use of the lens.

The chemical analysis of a fragment of the meteorite made by Dr. Edgar Everhart, chemist of the Geological Survey of Georgia, is here given, together with the analyses of four other meteorites heretofore described which most closely resemble in chemical composition the Pickens County meteorite:

METEORITE ANALYSES

	Pickens Co., Georgia	Long Island, Kansas	Bluff, Texas	Shelburne, Ontario	Bjurböle, Finland
SiO_2	37.06	35.65	37.70	39.19	41.06
Al_2O_3	5.83	3.08	2.17	2.15	2.55
Fe_2O_3	10.69				
FeO	9.63	22.85	23.82	15.16	13.80
MgO	24.00	22.74	25.94	26.24	25.75
CaO	0.55	1.40	2.20	1.75	1.82
Na_2O	0.92	0.25		0.73	1.24
K_2O	0.02	0.03		0.22	0.32
H_2O		1.52			
TiO_2	0.09	trace			
P or P_2O_5	0.31	0.06	0.25	0.06	0.14
S	1.57	1.90	1.30	1.61	FeS 5.44
Cr_2O_3	0.40	6.33		0.62	0.59
NiO		0.77	1.59		0.07
CoO		0.06	0.16		
MnO	0.40	trace	0.45	0.12	0.12
Fe	8.22	2.60	3.47	10.70	6.38
Ni	1.23	0.67	0.65	0.78	0.72
Co	0.11	0.04	0.09	0.04	0.04
O for limonite	Cu 0.06	0.90			
	101.09	100.85	99.79	99.37	100.04
Less O = S	0.79	0.95	0.65		
Less O = P		0.10			
	100.30	99.80	99.14	99.37	100.04

It will be noticed by comparing these several analyses that the Pickens County meteorite is especially noted for the high percentage of titanium oxide.

I am indebted to Dr. Oliver C. Farrington, curator of geology, Field Museum of Natural History, Chicago, for the following notes on the microscopic study of a section of the meteorite:

The meteorite is not characterized by prevailing chondritic structure. Nevertheless, well-developed chondri are occasionally to be seen in the section. One of these, of circular form with a sharply defined boundary, consists of fibrous enstatite showing the usual fan-shaped arrangement, and has a diameter of 1 mm. Another chondrus of the same mineral has an irregular boundary and is somewhat smaller. The fibers of this chondrus are characterized by unusual breadth, one being .0025 of a millimeter wide. Two sets of fibers at right angles are to be seen, giving an appearance of the well-known grating structure of microcline. The fibers also contain granular inclusions arranged parallel to their long axis. Another enstatite chondrus seen is of oval form with diameters of .4 and .8 of a millimeter; another of porphyritic chrysolite is marked by an irregular contour and a diameter of .6 of a millimeter; another made up of parallel rods of chrysolite and glass is much smaller, showing a diameter of .2 of a millimeter. The preceding illustrate the principal features and sizes of most of the chondri seen. The remainder of the section is made up of an aggregate of siliceous and metallic grains irregular in size and shape. Few of these have well-defined crystal outlines. Where such outlines appear the parallel extinction and high interference colors show the mineral to be chrysolite. Irregular fragments of parallel rods of chrysolite and glass of fibrous enstatite which appear here and there suggest that they once belonged to chondri, yet it is possible that they were formed in place. Grains of nickel-iron of various sizes and shapes are very abundant and are disseminated rather uniformly over the section. One of these of reniform outline is of unusual size, being 2 mm. in length. Inclusions of troilite are to be seen at several points in the body of this nodule. A narrow, dark, opaque border of oxide separates the nodule as a whole from the adjoining silicates. Such individuals were evidently formed previous to the adjacent silicates, but most of the smaller metallic grains occupy interstices between the silicates, and hence originated subsequent to the latter. These smaller nickel-iron grains are very irregular in form. At times the nickel-iron also occurs in narrow, much elongated, irregular forms suggesting short veins. These likewise have a dark opaque border. Troilite is to be seen in but small quantity in comparison with the nickel-iron. Most of the siliceous grains show a considerable amount of fissuring, the fissures being filled with a dark red limonite. In addition, the section as a whole shows a rusty staining irregularly distributed, and there is an impregnation in places of a black, opaque, perhaps carbonaceous substance. There is apparently no crust to be seen upon this section.

S. W. McCALLIE

SOME CONDITIONS FAVORING NITRIFICATION IN SOILS

KELLERMAN and Robinson[1] have lately reported nitrifying tests of North Carolina soils on which legumes were grown, which tests lead to directly opposite conclusions from those reached by Stevens and Withers,[2] who, working with soils from the same state, found that a large percentage of the soils they tested failed to nitrify. Kellerman and Robinson are further led to believe that "nitrification, nodule formation upon certain species of legumes, and the litmus reaction are correlated."

Results obtained in this laboratory indicate that nitrification is favored by an increase in the basicity when the soil is deficient in lime. Our experiments further indicate that the growth of alfalfa on the soil favors nitrification, or, at least, increases the availability of the soil nitrogen.

Nitrification tests on samples of soil from four limed and four unlimed plats averaged twice as great an increase in nitrates on the limed soil as the result of a ten-day test, and tripled the nitrate production in a three-week test as a result of incorporating lime with the soil in the field. The lime was added four years before the tests were made.

The increased production of nitrates on alfalfa soil as compared with a perennial non-legume was not so striking, but the favorable

[1] SCIENCE, N. S., XXX., No. 769, p. 413.

[2] SCIENCE, N. S., XXIX., No. 743, p. 506.

influence of the legume on nitrification is indicated by the following figures:

	Nitrates in Original Sample p.p.m. Dry Soil	Nitrates at End of Ten-Day Test p.p.m. Dry Soil	Nitrates at End of Three-Week Test p.p.m. Dry Soil
Soil from alfalfa plat	5.5	182	381
Soil from timothy plat	7.4	152	361
Soil from alfalfa and timothy plat	8.0	202	384
Soil from alfalfa plat	10.5	196	402

These plats had all been limed to their indicated requirements. The nitrification tests were made according to the following method: 100 grams of the moist soil were placed in a 250-c.c. bottle. To this was added 500 milligrams of ammonium sulfate and sufficient water to bring the soil to a moisture content of 25 per cent. calculated on the basis of dry soil. The bottle after insertion of a tight cotton plug in the mouth was placed in the incubator and kept at a temperature of 30° C. for the time indicated. Once each week water was added to replace that lost by evaporation. Nitrates were determined according to the method described in Bulletin 31, Bureau of Soils, U. S. Department of Agriculture.

That the availability of the soil nitrogen is increased by the growth of alfalfa is also indicated by analyses of timothy when grown alone and when growing as a mixture of timothy and alfalfa. The pure timothy, entirely isolated from other plants, contained a higher percentage of nitrogen when grown with alfalfa than when grown alone. This was true on both the limed and the unlimed soil. Alfalfa, and possibly other legumes, are thus of immediate benefit to the soil and to the crop growing with them.

The fact that Kellerman and Robinson were dealing with soils growing leguminous crops while Stevens and Withers tested soils without regard to the crop grown upon them may, in a measure, account for the more pronounced nitrification found by the former investigators. The writers must state, however, that they have not found any natural field soils in which nitrification does not take place.

Analyses of *Erigeron annuus* growing on limed and unlimed soil showed, in nine out of ten cases, a higher percentage of nitrogen in the plants growing on limed soil. The soil was deficient in lime. This is mentioned as another indication that nitrification, or at least the availability of soil nitrogen, is increased by the use of lime on soils in which they are deficient.

Our conclusion is that the presence of a certain degree of basicity in the soil, and possibly the growth of certain nodule-bearing legumes, are each favorable to nitrification in the soil. These and other conditions may account for very considerable differences in nitrification tests in different soils.

T. LYTTLETON LYON
JAS. A. BIZZELL
CORNELL UNIVERSITY

THE NATIONAL ACADEMY OF SCIENCES

THE autumn meeting of the academy was held at Princeton on November 16, 17 and 18. The general program was as follows:

TUESDAY, NOVEMBER 16

10:00 A.M.	Meeting of Council.
11:00	Scientific Session.
12:45 P.M.	Address of Welcome by President Wilson.
1:15	Luncheon.
2:15–3:15	Scientific Session.
3:15	Lecture on the Investigations of Joseph Henry, illustrated by Professor Henry's own apparatus, by Professor W. F. Magie.
4:30	Reception of the Academy and guests by Mr. and Mrs. A. D. Russell.
8:00	Dinner to the Academy by the President and Faculty of Princeton University.

WEDNESDAY, NOVEMBER 17

10:00 A.M.	Meeting of Council.
11:00	Business Session.
1:00 P.M.	Luncheon.
2:30	Scientific Session.
3:00–5:00	Conversazione: An exhibition illustrating recent scientific investigations, open to the public, in the Museum, Guyot Hall.
8:00	Concert of the Philadelphia Orchestra.

9:30 Reception of the Academy and guests by President and Mrs. Wilson.

THURSDAY, NOVEMBER 18

10:00 A.M. Scientific Session.

1:00 P.M. Luncheon.

The program of papers to be presented was as follows:

"On the Presence of Teeth in *Echinoneus* Van Phels," A. Agassiz, Cambridge, Mass.

"The Geology of South Africa," W. B. Scott, Princeton, N. J.

"Formative Substances in Eggs," E. G. Conklin, Princeton, N. J.

"A Study of Immunity to Self-fertilization in *Ciona*," T. H. Morgan, New York.

"Meteor Crater, Arizona," D. M. Barringer, Philadelphia (introduced by W. B. Scott).

"Derivatives of Tantalum," E. F. Smith, Philadelphia.

"Some New Methods in Electro-analysis," E. F. Smith, Philadelphia.

"The Emission of Electricity by Hot Bodies," O. W. Richardson, Princeton, N. J. (introduced by W. B. Scott).

"The Physiography of Southeastern Alaska," W. M. Davis, Cambridge, Mass.

"The Yale Expedition of 1909 to Palestine and Syria," E. Huntington, New Haven, Conn. (introduced by W. M. Davis).

"The Early Stages of *Acmæa*," E. S. Morse, Salem, Mass.

"The Transmission of Epidemic Poliomyelitis to Monkeys," S. Flexner, New York.

"The Present Status of the Ether," A. G. Webster, Worcester, Mass.

"Examples of Recent Photographs made at the Yerkes Observatory," E. B. Frost, Madison Bay, Wis.

"The Development of *Olenellus*," C. D. Walcott, Washington, D. C.

"Report of Investigations on the Correlation of Tertiary and Quaternary Horizons in Europe and North America," H. F. Osborn, New York.

"The Skull of *Tyrannosaurus*," H. F. Osborn, New York.

"The Fission of Double Stars," H. N. Russell, Princeton, N. J. (introduced by W. B. Scott).

"The First Movements of the Vertebrate Embryo in Relation to the Development of the Nervous System," S. Paton, Princeton, N. J. (introduced by E. G. Conklin).

"The Development of Electric Tissue in Teleost Fishes," U. Dahlgren, Princeton, N. J. (introduced by E. G. Conklin).

"The Relative Sizes of Cells and Nuclei," E. G. Conklin, Princeton, N. J.

"Memoir of Wolcott Gibbs," F. W. Clarke, Washington, D. C.

"Biographical Sketch of C. A. Young," E. B. Frost, Madison Bay, Wis.

"Memoir of W. K. Brooks," E. G. Conklin, Princeton, N. J.

SOCIETIES AND ACADEMIES

THE NEW YORK ACADEMY OF SCIENCES—SECTION OF ANTHROPOLOGY AND PSYCHOLOGY

A MEETING was held, in conjunction with the American Ethnological Society, on October 25, at the American Museum of Natural History, Dr. Fishberg occupying the chair.

Dr. Robert H. Lowie, in discussing "The Age-societies of the Plains Indians," distinguished between the genuine feasting age-societies of old, middle-aged and young men found among the Omaha and the ceremonial age-groups of the Arapaho, Gros Ventre, Blackfoot and Village tribes. The latter do not seem to correspond to fundamental age-divisions, so that some other factor of as yet problematic character must be assumed to have entered in their development. The lecturer insisted that these ceremonial organizations can not be classified on the basis of single characteristics, even though these involve the ostensible conditions of membership, but that it is necessary to isolate well-marked single features and to study their diffusion and the various combinations into which they enter.

Mr. Leo J. Frachtenberg presented some "Notes on Coos Ethnology," in which he stated that the Coos Indians of northwestern Oregon form an independent linguistic stock. Their language may be subdivided into two distinct dialects, called Ha'nīs and Mī'luk. The Mī'luk dialect is extinct, while Ha'nīs is still spoken by about thirty individuals living between Acme and Florence, in Lane County, Oregon. The long intercourse between the Coos Indians and the white settlers has effected a total assimilation of the Red Man. To such an extent is this so that the Coos show no traces whatever of the ancient Indian mode of life. There are, however, a few individuals who still remember phases of this life. The information obtained from these individuals tends to show that the ancient Coos customs and habits varied very little from those prevailing among the other tribes of the Pacific coast. The most important differences may be summed up as fol-

lows: The Coos were a peaceful tribe. They seldom resorted to war and never practised scalping. Flattening of heads was unknown among them, as was likewise tattooing. Their implements and utensils show an absolute lack of decorative art, and their festivals were devoid of any ceremonial significance.

R. S. Woodworth,
Secretary

THE AMERICAN CHEMICAL SOCIETY
NEW YORK SECTION

The second regular meeting of the session of 1909–10 was held at the Chemists' Club on November 5.

The Wm. H. Nichols medal, awarded annually for the best paper read before the section, was presented to L. H. Baekeland, Sc.D., for "Researches on Bakelite."

The chairman, Dr. Morris Loeb, in presenting the medal, said that aside from increasing the interest in the meetings of the New York Section, the medal afforded the very pleasant and gratifying result of showing appreciation of the work done by a friend and fellow member. He took particular pleasure also in crowning bakelite on the occasion of Dr. Baekeland's twenty-fifth anniversary of his doctorate.

Dr. Baekeland, in reply, expressed his hearty appreciation of the honor extended to him and of the many expressions of friendship and good will accompanying the medal. He described some recent applications of bakelite in veneering and in the manufacture of composition billiard balls which showed greater resiliency than ivory; also a method of running a mixture of the initial condensation product and wood pulp on a Fourdrinier wire, thus obtaining a coarse paper which could be converted by the application of heat and pressure into many useful forms.

The chairman called on Dr. Nichols, who, after speaking in high terms of Dr. Baekeland's work, passed to the subject of the eighth International Congress of Applied Chemistry. He regarded it as most important that during the next three years we should produce such papers and research work as to show the American chemists equal to any chemists in the world. Dr. Nichols described the preliminary plans for the congress of 1912, saying that the original committee would be enlarged so as to represent the whole United States, covering every branch and every phase of science; the invitation to meet in America was received with great enthusiasm in London and its popularity is spreading rapidly through the states, affording support and confidence to those in charge of the work.

Mr. Richard H. Gaines read a paper on "Bacterial Activity as a Corrosive Influence in the Soil."

Dr. F. B. Power's paper, "The Chemical Examination of Jalap," was presented in abstract by Dr. R. W. Moore and discussed at length by Dr. Virgil Coblentz.

Dr. Wilder D. Bancroft gave some further results in photo-chemistry under the title "Stannous Chloride and Solarization."

Professor A. A. Breneman gave a résumé of his investigations on "Sewer Explosions in the City of New York."

C. M. Joyce,
Secretary

THE ELISHA MITCHELL SCIENTIFIC SOCIETY OF THE UNIVERSITY OF NORTH CAROLINA

The 184th meeting was held in the main lecture room of Chemistry Hall, Wednesday, October 20, 1909, 7:30 P.M. The following papers were presented:

"Yosemite Valley and the Big Trees" (lantern slides), by Professor W. C. Coker.

"The Anatomical Reaction of Nerve Cells in Normal and Excessive Muscular Exertion" (illustrated with colored charts), by Professor D. H. Dolley.

The 185th meeting was held in the main lecture hall of the Chemistry Building, Tuesday evening, November 9, 1909. Professor H. V. Wilson presented the results of his investigations during the past summer at the Beaufort (N. C.) Fisheries Laboratory upon "The Structure and Regeneration of the Skin in Sponges." Dr. A. S. Wheeler, in his paper on "A New Study of Oceanic Salts," gave an outline of work done the past summer at the same laboratory. Samples of water taken from five points in the harbor were analyzed with unusual care. The differences in composition were found to be exceedingly small. Professor A. H. Patterson, in his paper "The Personal Equation in Judgment of Length, Mass and Time," presented the results of a series of tests upon a class in physics of twenty-two men. The averages of the guesses in most cases were above the true values. The maximum and minimum figures were usually much above and below the correct ones.

A. S. Wheeler,
Recording Secretary